



**Information Services  
Opportunities & Trends, 1994-1999**

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# **Transportation**

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**U.S. Market Analysis Program**



**Information Services  
Opportunities & Trends, 1994-1999**

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# **Transportation**

November 1994

*Input*

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**Frankfurt**  
Sudetenstraße 9  
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Niederkleen  
Germany  
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**London**  
17 Hill Street  
London W1X 7FB  
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400 Frank W. Burr Blvd.  
Teaneck, NJ 07666  
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**Paris**  
24, avenue du Recteur  
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Fax +33 (1) 46 47 69 50

**San Francisco**  
1881 Landings Drive  
Mountain View  
CA 94043-0848  
U.S.A.  
Tel. 1 (415) 961-3300  
Fax 1 (415) 961-3966

**Tokyo**  
Saida Building, 4-6,  
Kanda Sakuma-cho  
Chiyoda-ku, Tokyo 101  
Japan  
Tel. +81 3 3864-0531  
Fax +81 3 3864-4114

**Washington, D.C.**  
1953 Gallows Road  
Suite 560  
Vienna, VA 22182  
U.S.A.  
Tel. 1 (703) 847-6870  
Fax 1 (703) 847-6872

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**U.S. Information Services Market  
Analysis Program**

***Transportation***

***Information Services Opportunities and  
Trends, 1994-1999***

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# Introduction

## A

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### Purpose, Methodology and Organization

This section identifies the purpose and scope of this report, identifies key issues affecting information services expenditures in the transportation services industry market sector, and notes how the document is organized.

#### 1. Purpose

The purpose of this transportation industry forecast report is to describe the evolving transportation service industry, identify the key factors in these product/service markets and provide the 1994 INPUT forecast for information services in major segments of this industry.

Key Issues—INPUT believes that an understanding of the issues confronted by the industry and its underlying sectors is significant for comprehension of their information services direction. With this understanding, appropriate market strategies for the focused information services vendor become clearer.

- Because transportation is generally a business service industry, its fortunes are tied to the economy—the global economy. Will the domestic and international economy recover sufficiently for the industry to continue the pace of technology implementation?
- How well positioned are U.S. transportation companies to take advantage of an improved economy? Are they taking the appropriate actions to address sector problem areas, such as capacity, consolidation, communications and staffing?

- Knowledge of several concepts and technologies—global positioning, automatic equipment identification, logistics and the pervasive EDI—is fundamental to understanding the directions of transportation service providers.
- Smaller transportation companies without the financial resources, or the perceived need, for these expensive technologies may be forced to become involved.
- What are the technology highlights of 1993 and early 1994 that may be predictors of future opportunity in the transportation sector?

## **2. Related Reports**

Market Analysis Program:

*U. S. Professional Services Market Analysis Report*

*U. S. Application Solutions Market Analysis Report*

*U. S. Network Services Market Analysis Report*

*U. S. Processing Services Market Analysis Report*

*U. S. Systems Software Products Market Analysis Report*

*U. S. Business Integration Market Analysis Report*

*U. S. Outsourcing Market Analysis Report*

Electronic Commerce Program:

*Electronic Commerce: Comprehensive Market Assessment*

*Electronic Commerce in Trade and Transportation*

## **3. Organization**

In addition to this introductory chapter, the report contains analyses of the industry, information services market and competitive environment as described below:

Chapter II, Events , Trends and Issues, discusses changes, market issues and activities and competitive factors in the transportation industry and its segments that can have an impact on the current and future use of information services.

Chapter III, Information Systems Environment, presents a discussion of the overall sector's IS environment, the key application activities, transportation firms as technology vendors and what technologies are indicative of the future growth in the sector. Where significant, the separate transport modes are discussed individually. The chapter also describes various recent and ongoing technology activities within the segments of transportation industry.

Chapter IV, Information Services Market Forecast, gives INPUT's analysis of expenditures for information services by product/service market and submarket for the U.S. transportation services market and, where applicable, by transportation segment.

Chapter V, Competitive Environment, includes data on vendor activities addressing the transportation industry and its segments by application area, product/service market and size. In addition, positioning among the vendors is discussed, as is the importance of transportation companies as technology vendors. A selection of vendor profiles is also provided.

Chapter VI contains INPUT's Conclusions and Recommendations for the transportation technology market.

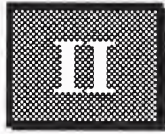
#### Appendixes:

Appendix A contains the Forecast Database, presenting a detailed forecast by product/service market and submarket for the transportation industry vertical market. A reconciliation to the previous forecast is also provided.

Appendix B discusses transportation industry structure and the methodology used in report creation, and lists INPUT reports that should be reviewed by the reader to obtain more information on this topic.

Appendix C contains industry-specific definitions.

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## Executive Overview

The transportation industry enters 1994 following a much better financial year than was discussed in INPUT's prior report in 1992. That year's Fortune Transportation 50 list lost a collective \$1 billion. The 1993 edition of the same list showed a \$6.7 billion profit. Much of this can be attributed to lower losses for most airlines. However, within the profit are reorganization credits for Continental and TWA of \$3.6 billion, a significant profit plus.

Primary among the reasons for the turnaround are an improved U.S. economy over 1992 and the results of substantial transportation sector downsizing. Downsizing has taken the form of staffing reductions (e.g., two- and three-man train crews instead of four) and reductions in subsector capacity (e.g., airlines retired some aircraft and delayed orders for others).

Because the U.S. Department of Commerce has forecast a better 1994, the trend toward profits should continue for the slimmer organizations.

### A

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## Key Trends and Issues Summary

Beyond the expected economic improvements, INPUT believes that there are other trends that will have an impact on transportation. In addition, there are open issues that, resolved favorably, could improve the fortunes of the transportation sector even more over time.

### 1. Trends

Transportation comprises the set of services that assist the movement of goods and people, generally for a fee. Goods include raw materials, parts and finished products, all of which require movement. Moving people relates to moving them to where they have to be or want to be. Although there is certainly mixing, as passenger aircraft also carry cargo, the major

break in transportation is the isolation of passenger and freight. In terms of trends, there are different factors for the two entities.

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**Exhibit II-1****Passenger Trends**

- Major airlines stress international travel
- Hot Southwest-type competition domestically
- Rail competition with high speed

Southwest runs an operation that seemingly does it all better, from on-time performance to keeping better track of baggage. Its structure helps: it flies mostly point-to-point, its average flight is short (350 miles) and it has leadership that heightens people performance. In defense, several of the major airlines (United, USAir and Continental) are structuring low-price subsidiaries to compete.

Amtrak failed to increase passenger traffic as much as forecast by the U.S. Department of Commerce for 1993. However, its trials of high-speed trainsets for future use on its heavily traveled corridors have been impressive. Because nine of Amtrak's routes provide service that is parallel to heavily traveled and short air routes, INPUT believes that Amtrak will have the opportunity to increase ridership when high-speed trains roll. This is of interest in Boston, where travelers can now look at rail as an alternative to airport expansion. In addition, Baltimore's BWI airport already has an Amtrak station. Freight trends are listed in Exhibit II-2.

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**Exhibit II-2****Freight Trends**

- High growth for intermodal
- Trucking will condense in carriers
- Seamless EDI and direct shipper access

The highest growth figures in freight are in intermodal, the shipment of trailers and containers by railroad and ships. A record seven million

intermodal shipments for rail occurred in 1993. Most were containers in efficient double-stack configurations. This current history is bolstered by the planned replacement of truck trailers with containers by the two largest truck load companies.

As in all of transportation, the big carriers tend to grow at the expense of the small, if we disregard some of the monumental business failures (Pan Am, et al). INPUT anticipates that this will accelerate, particularly with the increasing requirements for EDI and shipment tracking being pressed by shippers. The expense of doing business in a technology-driven world will be too great for the small companies.

Finally, freight carriers are being expected to provide a seamless service, regardless of the numbers of carriers that may assist on any given shipment. Indeed, a transportation company's biggest customer is frequently another transportation company.

## 2. Issues

The big U.S. transportation firms are no longer domestic entities. The positive impact on global trade caused by the breakdown of barriers will shortly be evident and continue at a greater pace throughout the decade. In the western hemisphere, the initial impetus is the North American Free Trade Agreement (NAFTA), which will be a positive benefit to all sector firms. INPUT believes that job losses will be more than made up for in trade increases, which yield more goods for shipment.

Consolidation in the transportation industry is affecting both the freight and passenger subsectors (five air carriers now control 80% of the market). In freight, this will be driven by many factors and fostered by the blending of the modes and the required technological interconnection of the players. Blending is taking place in the form of mergers, acquisitions and affiliations. Although the question of which subsector will dominate is open, the customer will surely win because all modes are racing to provide seamless movement. Big trucking has the edge, along with rail, in appearing to be content to be growing their "behind the scenes" business.

Just as trade is the impetus for transportation, technology has become the glue that holds the pieces together. Electronic commerce is the movement of data that supports the flow of people and goods. It is required to provide seamless service for customers. In many cases, the pressure to implement EDI and shipment tracking is from the customers of transportation. Transportation frequently has not seen the potential

economies and efficiencies achievable with electronic commerce, but industry participants are learning.

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**B**

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**Information Services Market Summary**

INPUT believes that transportation has shown itself to be a better-than-average market for professional services assistance in technology. Current research has not shown transporters to be shifting to the systems integration style of contracting, but INPUT believes that this will occur over time.

Until 1993, outsourcing and the systems operations market within the transportation sector had been small compared with other industry sectors. However, the ISSC contract with Southern Pacific Rail set a precedent. INPUT believes that this will improve the opportunity for outsourcing within the sector.

Mainframe predominance in even active sector applications projects could be a surprise. It should not be, since transportation companies have been long-time computer users. INPUT believes that this preference will shift to client/server and workstation development over time. However, vendors should be prepared to address mainframe considerations.

EDI was part of most application development projects in transportation firms during 1993, with the highest percentage—61%—of any industry sector. INPUT believes that this will continue to be the case for some time to come. In addition, the attachment of AEI tags on equipment for future tracking is proceeding at a fever pitch. Proper fulfillment of the expected ability to provide shipment tracking data based on AEI will require change to EDI systems to transmit this data and systems to process the information. This should spell technology vendor opportunity for assistance.

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**C**

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**Conclusions and Recommendations**

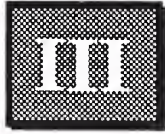
What is lacking in some of the current technology implementation is the sense of what it can do for the transport company. Do railroads believe that AEI-based equipment tracking can provide cost savings? Many see these tags as a multimillion-dollar expense that does not provide savings or increase their business. Technology vendors need to help transportation's IS organizations devise ways to utilize this explosion of information in ways that will benefit the business.

Certainly one of the benefits of more current information is to provide better information to shippers and their customers. Most transportation firms have begun to see their business less from an operational view and more from the customer view. Santa Fe's new system is built around the shipment rather than the rail car, as was the basis for prior railroad systems.

Historically, transportation, with the exception of airlines, has been viewed as an unattractive technology market. When asked about its transportation business, one equipment manufacturer responded with, "Oh, you mean airlines." Although transportation is a relatively poor industry sector in terms of profit margins, INPUT expects its growth in technology spending to exceed growth in revenues. The primary cause of this in freight will be the need to integrate EDI and real-time location data within processing and decision systems, as well as to respond to customer inquiries.

Finally, transportation knowledge and experience is a prerequisite for the successful vendor. Industry firms first seek those with experience within their subsector, then within other subsectors, but rarely beyond transportation. This is the case for employees as well as vendors. Further evidence is the success of transport firms as technology vendors, e.g., SABRE Technology, CSX, Conrail and Santa Fe. Breaking in is very hard to do without credentials and references.

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## Events, Trends and Issues

### A General Business Trends and Events

As documented by the U.S. Department of Commerce in its 1994 edition of the *U.S. Industrial Outlook*, the U.S. economy grew 2.6% in 1993, a rate of growth identical to that of 1992. Key 1993 economic indicators were generally favorable, with before-tax corporate profits growing to 11.8% (from 9.1% in 1992), and the housing and automotive industries both showing moderate but steady growth. Inflation in 1993, as measured by *Blue Chip* consensus of approximately 50 private-sector economists, was a mild 2.5%, and is projected at 3.0% for 1994, with a five-year average rate of 3.3% through 1999. The heavy Midwest flooding in 1993 had some impact on agriculture's contribution to 1993 GDP, but that was offset by the expenditures for repairs and replacement from flood damage. An unresolved 1994 federal issue is the proposed health care reform bill, and the effect it may have on both health care and the economy, depending upon when, and in what form, it is enacted.

Most economists and business analysts agree that 1994 will be another year of moderate but steady growth, with the U.S. economy improving its growth to 2.9% and corporations maintaining earnings growth at double-digit levels. Much of the corporate growth is attributed to a strong and continuing emphasis on cost cutting and productivity gains—two concepts that have already contributed to corporate gains. Consumer confidence appears to be increasing (as exemplified by the growth in housing starts and auto production), and personal spending is expected to grow from 2.9% to 3.0% in 1994. Areas of economic concern include continued cutbacks in defense spending, a lingering weakness in the commercial real estate market, corporate restructuring (specifically downsizing) that will further limit employment growth, and the economic problems that continue to plague major U.S. trading partners such as Western Europe and Japan.

Overall, however, the outlook for the U.S. economy in 1994 is for controlled, steady growth in the 3% range with inflation at that level or slightly less, and corporate before-tax profits at 10% or better.

**B**

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**Specific Industry Trends, Events and Issues**

To understand the U.S. transportation industry one must comprehend that its purpose—the movement of goods and people—is all that links the group of companies into an industry. The transport modes (rail, air, truck, water and pipeline) do not share SIC codes. Intermode competition raises stronger feelings than competition among the entities of a mode. Government action and support is normally mode based.

The basis of the transportation service sector is in assisting the movements of people and goods. Raw materials and parts are moved to producers whose finished products are then moved to where customers want them. People are moved to where they have to be or wish to be. The transportation sector grows to support growth in the amount of goods or travelers to be moved. Both are generally driven by factors that are not within the control of transportation. Hence, the perpetual struggle has been among the players to increase their share of a relatively fixed market for transport. There are exceptions where transportation by itself creates additional business. Two examples show what it takes to create business:

- Federal Express invented the next-day package delivery business. Did this innovation in speed induce more packages than would have been presented for transport, or were the vast majority of these packages diverted from other transportation means?
- Southwest Airlines' low fares have shown that it is possible to cause dramatic growth in air travel between two points: The Louisville-to-Chicago route grew from 8,000 to 26,000 weekly passengers. How many of these people were induced to fly rather than use other means because of the low fares, and how many would not have made the trip at all?

Certainly these were substantial events that have added new transport business; but stories of the ability for transportation firms to create new business are the exception. Most of any sector firm's growth beyond the level of global economic growth is at the expense of an alternative transportation company.

Primarily, beyond our automobile travel and vacation activities, transportation companies are business support entities. The most common criteria for selection among the various modes are: price, service and timeliness. Collectively our transportation system is an economic enabler. However, the reverse is also true; the continued sluggishness of global economic growth has shown in the financial results of the transportation industry sector.

In May 1994, *Fortune* magazine listed "The Service 500" which includes the largest U.S. service corporations. The Service 500 list is broken into eight subgroups: 100 diversified companies (like AT&T and EDS); 100 commercial banks; and 50 each for diversified financial, savings institutions, life insurers, retailers, and utilities.

"Profits for Fortune's Service 500 rose 28%, to \$93.7 billion, the largest increase in five years. Productivity gains and historically low interest rates provided the one-two punch. Final tally showed the Service list's bottom line \$31.1 billion ahead of its industrial counterpart."

The *Fortune* Transportation 50 rebounded from being the only losing group in 1992 to one with a \$6.7 billion group profit in 1993. The negative drag in 1993 by the major airlines was much less in 1993 than in 1992. The *Fortune* transportation comment is as follows:

"Airlines finally headed in the right direction; the ten that carried over from last year's transportation list went from losing \$4.6 billion to earning \$1.7 billion."

Though the statement is accurate, within this miraculous swing are the bankruptcy reorganization credits received by Continental (\$3.6 billion) and TWA (\$1.1 billion). With these large credits removed, airlines really went from a 1992 loss of \$4.6 billion to a 1993 loss of \$3.0 billion.

Although this realization tarnishes the shining statement, it should not eliminate the positive story that airlines recorded profit turnaround in 1993. The major U.S. airlines still lost a lot of money, but did much better than recent history, particularly with domestic traffic measured in revenue passenger miles down from 1992.

Fourteen of the fifty companies, including five airlines, were adversely impacted by SFAS 106 in 1993, which INPUT estimates to have cost the transportation sector in excess of \$275 million in 1993 profits. Because all corporations were required to take this one-time accounting change by the end of 1993 to account for future retiree benefits, it will have no further corporate impact.

The transportation list of "The 50 Largest Transportation Companies" in the United States, with total 1993 revenues of \$174 billion—an increase of 13.7% over the \$153 billion for 1992—includes:

- 10 railroads, 9 profitable with a total of \$2.5 billion positive
- 10 airlines, only 4 with profits of \$1.7 billion
- 10 trucking firms, 9 showing profits
- 4 shipping companies, 3 profitable
- 6 pipelines that were all profitable
- 3 package specialists, all showing positive results
- 6 leasing and transportation support companies, 5 profitable
- 1 bus line making a modest profit

The 1993 losers were primarily airlines, as they were in 1992. Even including the nine losing airlines, the 50 largest transportation sector firms ended 1993 with a profit of \$6.7 billion, up from \$3.6 billion in 1992, an 86% improvement. Hence, transportation is not an unhealthy industry, only some of its players are financially unhealthy. Additionally, much of the U.S. transportation sector is poised to operate with substantially lower costs based on downsizing and capacity handling efforts. As the global economy improves, transportation should move upward in revenues and profits.

### 1. Events—1993

The continued slow growth in the U.S. economy, coupled with the recessed global economy, remained the primary negative events impacting the total transportation sector's revenues and profits in the past year.

Four government activities during 1993 were expected to have a direct impact on transport sector companies, particularly:

*NAFTA* was passed in October 1993, following significant controversy in Washington, though the anticipation had caused many pre-passage activities, particularly by transportation service companies, such as U.S.-Mexico rail alliances. Because the passage was more a formalization of the ongoing easing of tariffs and border restrictions than a dramatic

change, no immediate alteration was evident in 1993. However as the multiyear event timetable unfolds with inevitable increases in trade, the picture for direct transportation sector growth will become clearer.

The *Clean Air Act* regulations regarding cleaner diesel fuel were effective in October 1993, and served to increase the price of fuel for trucks and railroad locomotives by an estimated 3 to 8 cents per gallon. As forecast, this was a negative event for transport sector firms. However, the diesel engine technology clean-air advances made by U.S. manufacturers, primarily Caterpillar, Cummins and Detroit Diesel, have made them the hot international sellers as other countries begin to enforce cleaner engine standards.

When the fuel cost increase for cleaner fuel is added to the *1993 Fuel Tax* increase of 4.3 cents, a significant impact in bottom-line costs for both rail and truck is inevitable. Not so obvious is the inequity of impact. Because fuel is about 8% of a railroad's operating cost and 14% of a trucker's, the resulting impact on trucking costs is a greater factor and should serve to move the more price-conscious traffic to intermodal transport.

Finally, the *Airline Competitive Panel's* August 1993 report included three policy-level statements and several recommendations for change. However, little relief to the airline industry is expected to result in the near term because of the expected lag in legislative and regulatory change.

#### **a. Passengers—1993**

The total numbers of passengers carried intercity increased by a modest 19% in the twelve years between 1980 and 1992 (946 million to 1,123 million). Exhibit III-1 compares the breakdown by mode of travel for intercity passengers for 1980 and 1992.

Domestic Intercity Passengers by Mode of Travel, 1980-1992

	1980 (Percent)	1992 (Percent)
Air	29.1	38.8
Amtrak	2.2	2.0
Commutation	29.6	29.0
Bus	39.1	30.2

Source: *Transportation in America*, 1993

Airlines became the largest carrier of intercity passengers during the 1980s, increasing their share by 59%. Amtrak riders increased by 3%, but that was not enough to maintain Amtrak’s market share, although commutation was included because the mostly rail mode is similar to long-haul rail and is sometimes operated by Amtrak. Commuter traffic grew by 16% and basically held its market share. Bus includes charter and the major scheduled carriers (primarily Greyhound). Bus ridership dropped by 3% during this period primarily because of the protracted Greyhound strike and its drop of unprofitable routes.

i. Airlines

Most U.S. airlines, like those of the rest of the globe, struggled through 1993, suffering another year of all too common operating losses. It is said that in the last four years the world's airlines have lost more than has been made during the entire history of commercial aviation. The International Air Transport Association (IATA) blames their financial situation on overcapacity; too many aircraft added during the 1980s; the continued state of the world economy, which has reduced demand; and the impact of liberalized regulations, all of which fostered fare wars to fill the planes. U.S. air carriers have also blamed the government's lenient behavior toward the bankrupt carriers, but 1993 saw all three—Continental, TWA and America West—back from the brink. In fact, their reorganization credits were significant in making the 1993 airline picture look bright.

In 1993, U.S. airlines successfully moved to correct some of the ills created in the 1980s. First, they reduced capacity by retiring planes, reducing some hubs and pushing out aircraft orders. In addition, they negotiated better union agreements and strove to establish more reasonable yield patterns. Were it not for the depressed passenger

traffic, more than two of the ten largest carriers could have shown profits in 1993. As it was, only the high-flying Southwest (\$170 million profit) and America West (\$37 million) were profitable without bankruptcy credits.

Market share concentration continues to be a major airline industry factor. Exhibit III-2 compares the relative market shares of the major players in 1993 and 1991, and looks back at a good year—1985.

Exhibit III-2

### Airline Concentration in Market Share

Carrier	1993 (Percent)	1991 (Percent)	Carrier	1985 (Percent)
United	21.2	18.7	American	13.3
American	20.4	20.2	United	12.5
Delta	17.4	16.8	Eastern	10.0
Northwest	12.2	12.4	TWA	9.6
Continental	8.9	9.7	Delta	9.0
USAir	7.4	8.0	PanAm	8.1
TWA	4.8	6.7	Northwest	6.7
Southwest	3.5	2.6	Continental	4.9
America West	2.4	2.9	People Express	3.3
Alaska	1.2	1.2	Republic	3.2
Others	0.6	0.8	Others	19.4

*U.S. Department of Transportation*

Four of the top ten major airlines in 1993 did not even make it out of the "others" category in 1985. Four of the top ten 1985 airlines no longer exist. The 1993 top five have a better than 80% share; in 1985 it took ten airlines to capture an 80% share. United became the market share leader for 1993, surpassing American for the first time since before 1985. Of the top ten in 1993, only four increased their share over 1991 (the big winner—United—+ 2.5%, and American + 0.2%, Delta +0.6%, Southwest + 0.9%). Beyond the airlines that have disappeared since 1985, the biggest concentration of losers has been the airlines not in the top ten,

dropping from a 19.4% share to 0.6%. The big get bigger and the small struggle for a piece of a smaller share.

### *ii. Rail*

Railroads, primarily the 22-year-old Amtrak, moved 50 million passengers in 1993, up significantly from 1992. Amtrak succeeded in covering 79% of its operating costs in 1993, the same as in 1992. The taxpayer portion increased from \$500 million in 1992 to \$642 in 1993. Amtrak still holds to its projection of self-sufficiency by the year 2000. While Amtrak's 3% growth in intercity passengers was as projected, its operation of commuter rail for local governments swelled and now constitutes 56% (45% in 1992) of its total passenger traffic. The testing of high-speed rail offerings, all based on European technology, began in 1993 and is expected to be complete during 1994.

### *iii. Bus*

Greyhound, the only *Fortune*-listed bus carrier, recorded a profitable year (\$7.5 million), its second in a row. Charter operators, though none are major carriers, continue to do a brisk and profitable business.

### *iv. Water*

Water passenger travel is almost exclusively for vacation and business conference cruises, and was historically treated as travel and entertainment by *Fortune*. However, this year *Fortune* included Carnival Cruise Lines in its transportation 50 list. The high-profile company entered the list at number 25 with profits of \$318 million on revenues of \$1.6 billion.

## **b. Freight Carriers—1993**

Like much of transportation, in freight there are numbers that will make everyone the biggest in something. Exhibit III-3 shows the split of domestic freight in 1992 and the revenues for transportation subsectors.

## Exhibit III-3

**Transportation Subsector—Freight Share Comparison**

	<b>Ton-Miles (Percent)</b>	<b>Intercity Tons (Percent)</b>	<b>Revenues (\$Billions)</b>	<b>Percent</b>
Rail	37.4	25.0	30	8.3
Truck	27.6	43.1	293	80.1
Oil pipeline	19.3	16.3	20	5.5
Water	14.3	15.4	9*	2.5
Air	0.4	0.1	10*	0.8

\* includes international revenues

Source: *Transportation in America, 1993*

Rails haul the most long-distance freight. Trucks move the most freight, but for shorter distances than trains, and take in the most revenue. Pipelines make more than twice as much as water, for similar amounts of tonnage. The real revenue-per-ton winner is air, which makes more than water although it carries a relatively minuscule tonnage.

Excepting the large numbers of small companies in transportation, there are few major freight carriers that remain exclusively within their traditional niche. UPS is the largest U.S. transportation company and is regulated as a trucking firm, but it has a similar aircraft capacity to rival Federal Express. CSX is the largest rail-based company in revenue terms, but its subsidiary, Sea-Land, carried more containers over water than any other U.S. water carrier. Federal Express is the biggest U.S. air cargo carrier and, to the disgust of the trucking industry, its more than 30,000 ground vehicles are not ICC regulated.

*i. Multimodal*

Fostering the marriage of modes is the high growth of multimodal means of freight transport. Multimodal is the movement of a specific shipment by more than one transportation mode. Although the most common style is called intermodal, involving truck and rail, "multi" includes water and air cargo. With the exception of bulk commodities like coal, petroleum and grain, the common envelope for goods is becoming the shipping container. Much is happening with these common transportation elements, such as:

- The U.S.'s two largest trucking firms, JB Hunt and Schneider National, are shifting their trailer fleets to containers.
- Double-stack railroad capability, which uses special cars that carry containers two high and doubles train capacity without increasing length, accounted for almost 80% of all rail container movements in 1993. Until the completion of the Sarnia Tunnel between Canada and the U.S., expected in 1994, this form of rail transit was not possible to the U.S.'s northern neighbor. The tunnel will allow CN North America (the partially government owned Canadian railroad) to run these higher cars straight through to destinations in Canada.
- The growth in railroad intermodal continued to outpace almost all other growth factors in transportation with a 1992 to 1993 increase of 7.9%, and a record seven million movements. Rail industry people say that it could have been even more had they had more rolling equipment and better working load/unload yards. Most of the big rails are increasing capacity as fast as they can.

Indeed, except for the limited numbers of goods that move directly from producer to consumer in one truck, most shipments change hands several times during their passage. Making movements "shipper seamless" increases the need for transportation sector companies to work together.

### *ii. Railroads*

Rails enjoyed another great year, with traffic growing for the seventh consecutive year, though at a modest 2% for ton-miles. Railroad's primary commodity, coal, was off three percent, which repeats last year's volume drop. Railroads were also hurt by the record flooding problems in the midwest—damage alone was estimated in excess of \$250 million, with Burlington Northern taking one of the biggest hits. The rails' long-term effort to reduce train crews, automate for better equipment utilization and reduce operating costs has occurred. The hot growth area is intermodal, which has more than doubled over the past ten years and is even turning a profit. In light of the permanent nature of these changes, the rail outlook is very bright.

### *iii. Trucking*

Trucking continued its lead in total cargo volume and revenues, though profits for part of this highly fragmented mode are very slim. The truck mode has three basic carrier types: truck load (TL) carriers, who move full trucks for shippers; less-than-truckload (LTL) carriers, whose

shipments are usually bigger than packages, but that must be shifted from truck to truck to maintain efficiency and utilization; and private carriers, who are owned and operated by shippers. Some splits of this traffic are calculated to isolate certain significant elements: local delivery and package, which is part of LTL, but does not include the air carrier Federal Express (which would have been about 2.5% by itself). Exhibit III-4 shows the relative revenues for truck carrier types in 1992.

Exhibit III-4

### Truck Carrier Relative Revenues—1992

Carrier Type	Revenue (Percent)
Local delivery	41
Private carriers	30
For hire—ICC carriers	29
Truck load (TL)	16
Less-than-truck load (LTL)	13
Package	5

Private carrier revenues are inferred rather than actual because they are part of their served companies, but their volumes exceed those of the for-hire carriers. Industry experts believe that private cartage will diminish, as evidenced by the growth in contract carriers Ryder System (\$5.3 billion) and Penske Truck Leasing (\$902 million).

#### *iv. Oil Pipelines*

Oil pipelines (gas pipelines are included in the energy sector) are a major factor in the movement of goods, though they deal in just one commodity. In 1992 they were responsible for 55% of all petroleum ton-miles (water-41%, truck-3%, rail-1%). Most pipelines are owned by oil companies or their subsidiaries, and are very profitable because of the few employees required for operation. The revenues and amount of tonnage is related to the use of petroleum within the U.S. and the sources in any given year. For almost two decades the pipeline industry has had bursts of traffic increase with lengthy static periods. Since 1975, the total mileage of petroleum pipelines has remained basically unchanged at about 170,000 miles. Financially, since an almost fourfold growth in the late 1970s, both revenues and profits have cycled up and down through the years (revenue ranges between \$6.3 billion to \$7.8 billion and the profit

range is between \$1.9 billion and \$2.5 billion) with 1993 a year at the high end of these ranges. *Fortune's* listed pipeline companies have the distinction of being the only mode subgroup with no losses.

#### *v. Water Carriers*

Waterborne freight varied by subsector, with profits for oceangoing carriers and hard times for domestic, particularly inland barge carriers. The record-setting floods on the Mississippi River system during the spring and summer of 1993 disrupted traffic: Up to 1,000 barges were stuck—the equivalent of 60,000 truck loads—for protracted periods. The two months of disruption are estimated to have cost the carriers about \$3 million per day. Barges carry about 13 % of all the U.S. intercity freight traffic, primarily bulk cargoes, e.g., grain, coal, petroleum, fertilizer, cement, etc. Industry revenues are broadly stated at between \$1 billion and \$2 billion annually. Barge rates are artificially low because of the vast overcapacity that exists. In the late 1970s and early 1980s the federal government provided tax credits and loan guarantees for barge and towboat construction (to help the shipbuilders). During this period the number of barges swelled from 13,000 to 18,500 (a 42% increase in fleet capacity). Today's rates remain about half the 1980 level.

The "big two" of U.S. ocean trade are American President Lines (APL) and CSX's Sea-Land subsidiary. They have challenged U.S. policy makers to alter the regulations that force them to buy U.S.-built ships, staff with U.S. crews and other regulations that make their costs and prices uncompetitive. Their threat is to "re-flag" some or all of their ships. The concern in Washington is related to the military significance of maintaining a registered merchant marine for use in time of war. Because little seems to be happening in Washington, the January 1993 U.S. private fleet of 384 oceangoing merchant ships (with gross tonnage in excess of 1 million tons) may shrink again.

#### *vi. Air Cargo*

Based on ton miles, air cargo is hardly even a factor in the overall freight picture, with only a 0.4% share. However, the 1993 traffic growth for air cargo was very good when compared with passenger traffic. The U.S. Air Transport Association (ATA) reports 3.6% growth over 1992; the Association of European Airlines (AEA) reported a 6% growth; and the Airports Council International (ACI) observed that Latin America was even hotter, with a 12% increase. These increases are a surprise during a poor year for economic growth.

## 2. Trends

The *U.S. Industrial Outlook* for 1994, prepared by the U.S. Department of Commerce, predicts an improved economy and guardedly projects a better year for the four primary transportation industries—airlines, trucking, railroads and water transport, though slightly different by group:

"Airline traffic is projected to grow about four percent domestically and seven percent internationally, but the industry will struggle to achieve a balance between costs and fares. Regional airline growth will continue to outpace that of the larger carriers. Railroad traffic is forecast to continue to grow modestly, with revenue ton-miles projected to increase three percent. Passenger-miles traveled on Amtrak are projected to grow about four percent. Truckers can expect revenue growth of about six percent in 1994, but cost pressures, especially in wage and benefit areas, will squeeze profit margins in most markets. Increased trade and stronger freight rates should improve the performance of U.S.-flag liner companies operating in Asian markets. Domestic-flag liner traffic between Alaska and the lower 48 states should grow about three to four percent."

U.S. Department of Commerce and industry experts project the transportation industry as a whole to grow, in some segments dramatically.

INPUT believes that the transportation industry will continue to concentrate the number of entities through various mechanisms: merger, purchase, bankruptcy and affiliation, driven by attempts to reach the appropriate size, to counter the pressure of industry globalization and provide the capital resources to compete. Though all segments will see the creation of global megacarriers, the most obvious changes will be in the fragmented trucking segment, where the cost of entry is small. The new costs of competition will be too great for most existing firms. Also, the weaker business entities in all segments will fail to keep up and thus extinguish themselves, and the stronger, more nimble competitors will grow faster than the industry.

Specific trends for the most active segments can be instructive.

## a. Passenger Carriers

### i. Airlines

The year 1993 was not one for returning profits for the major U.S. carriers, though some came very close. American Airlines lost less for the year (\$110 million) than the cost of the flight attendant strike (\$180 million). For 1994, Standard & Poors economists predict potential profits for airlines of \$1 billion, based on traffic increases of 3% to 4%. The Federal Aviation Administration's twelve-year projection has an annual growth rate of 3.9% domestic and 6.6% international revenue passenger miles. The important trends are:

- The success of Southwest and its direct, low-cost flights has prompted several major carriers to create an "airline-within-an-airline" with similar features. It is expected that this form of price competition will continue through the decade.
- American states that the impact of general business downsizing and growth of electronic communications could cost it 11% of its business travelers by 1998.
- Employee ownership, like that recently achieved by United, may be the future model over the long term for labor-intensive transportation carriers.
- The number of hubs in the U.S. should decrease to 28 or less over the next few years as carriers rationalize route structures. However, the hub-spoke style will continue to predominate in the U.S.
- Although the U.S. aircraft fleet will grow slowly over the next five years, noise level regulations will force the retirement of almost half the current 4,300 planes by decade end. This will be felt most by the newer airlines that use leased older air craft.
- The hottest growth areas for airlines in the short term will be found in Asia and Latin America. Pacific Rim growth is 20% to 25% annually and China leads with growth projected in excess of 30%.

INPUT accurately projected the beginning of the loss turnaround for airlines in 1993 and that it would be too late in the year to produce absolute profits. INPUT believes that 1994 will see a return to profitability for most major U.S. airlines. The big three U.S. carriers are poised to take advantage of this growth and will successfully expand globally. Finally, the new start-up airlines (there have been 26 since the

end of 1990) will cause price pressure on the majors and take over many of the short-haul routes.

INPUT continues to believe that airlines will release control of their CRS businesses by the end of the decade. A sign of the pressure that promotes separation is the European Community Council of Transport Minister's CRS "code of conduct," issued in September of 1993, specifying that CRSs must be disconnected from their parent company's internal computers and that they must exist as a distinct legal entity. American and its SABRE system, which holds a 10% share of the European CRS market, is in direct conflict with this regulation.

#### *ii. Railroads*

Amtrak passenger rail fell far short of the U.S. Commerce Department's prediction of a 7% increase in passenger miles for 1993, with actual results showing a 2% increase. This is in line with longer term projections of between 2% and 3% growth through the end of the decade. Amtrak's contract to provide U.S. passenger service is due for renewal in 1996.

Much of the attention in passenger rail is in watching the movement toward higher speed trains. Of the top 25 airline markets, nine are short to medium distances that could be served by high-speed rail. The Northeast Corridor is one of these congested prime traffic markets that is also the subject of Amtrak tests of offerings from six bidder groups to provide high-speed trainsets. Contract award is scheduled for late 1994 and service for 1997. Other high-speed projects are under consideration for Texas (using the French TGV trainset between Houston, Dallas and San Antonio) and California (Los Angeles to San Jose).

INPUT sees higher speed rail as enhancing this segment's growth in the longer term, as airport and road congestion increase. This is particularly true in the Boston-to-Washington corridor. Shorter travel time and downtown terminals have made the Washington-New York Metroliner the favored travel mode. In addition, Massachusetts is viewing rail as a possible alternative to expansion of the crowded Boston airport. Higher speed capability would increase the potential of rail picking up travelers from air carriers and the roads. Lufthansa, the German airline, uses high-speed rail links not only to airports, but to replace some of its short-haul flights. This may be the model for U.S. airlines to provide an integrated people transport service.

## **b. Freight Carriers**

INPUT foresees a continued blending of surface freight, i.e., rail, truck and water, primarily driven by the close relationship and information exchange required to support the seamless movement expectations of shippers and customers. Whether it is called intermodal or multimodal, the survivors will perform it by providing customer service regardless of the shipment carrier transfers.

### *i. Railroads*

The U.S. Department of Commerce predicts the ton miles hauled by rail to continue their growth by 2% in 1994, but this is mainly a reflection of a resumption of coal shipments caused by economy growth. Though projected volume increases for the next five years are a modest 1% to 1.5%, this continues the segment's modest historical increases. Intermodal is rail's real growth area, projected at 3% to 5% annually over the next five years. This mode is cheaper for shippers and highly profitable for rail, particularly with the expanding double-stack capability.

INPUT believes that the actions of other transport modes combined with the capacity increases by railroads will cause intermodal to exceed current government projections. The shift from trailers to containers, the establishment of truck/rail affiliations, and the expected positive effects of NAFTA should see rail intermodal setting a new record in 1994.

### *ii. Trucking*

The trucking segment is projected by the U.S. Department of Commerce to maintain its domination of the U.S. freight market. Its share of revenues was 78% during 1993, an increase of 1% over the prior year. The trucking segment contains the largest U.S. transportation company and the world's second largest firm, UPS, in terms of revenues and 1993 profits that were in excess of \$800 million. This segment also contains the largest number of carriers, some 44,174 separate firms. By the end of the decade the number of firms will be drastically cut, probably by better than half, as the small "mom and pop" and the medium-sized carriers are eliminated by the sophisticated, well-managed large carriers.

### *iii. Air Cargo*

The rapid growth of air cargo businesses is expected to grow moderately at an annual 5% to 6% rate through the decade. Competition will be hot globally, particularly in small package delivery. Federal Express reported 17% growth in its international priority package revenues, though trends seem to be toward less time-dependent package offerings. Asia and Latin

America show growth beyond other areas of the globe for the non-package U.S.-based carriers.

INPUT believes that the next decade for transportation will be the emergence of a transportation industry from the mode segmentation that persists. This will be most evident in freight, where the mode of transit will become even more transparent and of little concern to the shipper.

### 3. Issues

Transportation is the benefactor and victim of the worldwide economy. When global economic growth is weak, or when substantive barriers to trade exist, transportation is negatively impacted. With the world's economy mending and worldwide pressure to reduce barriers becoming effective, trade and transportation should soar in this decade. Exhibit III-5 shows some of the issues that can impact transportation's growth.

Exhibit III-5

#### Transportation Issue Summary

- Consolidation
- Global Economy
- Technology

#### a. Consolidation

Consolidation does not just mean mergers and acquisitions; rather, it is defined as the forming of a compact mass. This is what the sector needs to achieve if customers' expectations of seamlessness are to be met. In airlines this is code-sharing, where systems are code integrated to use a single flight number to cross airline boundaries. For freight to achieve this requires similar integration, within and among the transport modes. EDI and advanced tracking systems offer the base for this.

#### b. Global Economy

Trade, and its enabler transportation, has long been a global issue. A growing economy in the U.S. alone does not support the transportation infrastructure. The import and export of goods and the travel of people to support international trade is required. Global economic improvement is what the U.S. transportation sector seeks.

to support international trade is required. Global economic improvement is what the U.S. transportation sector seeks.

The passage of NAFTA became a bipartisan effort in Washington and it is only one of several free trade agreements in current discussion that will affect the future of the U.S. transportation sector. Already, NAFTA has made a visible impact in Canadian transportation. An interesting visible sign of NAFTA's impact in transportation is found on the rails in Canada. Canadian Pacific (CP Rail) has recently "Americanized" its trademark by adding stars and stripes to its familiar maple leaf symbol. Not to be outdone, Canada's number-two railroad, the more conservative state-owned Canadian National Railroad (CN Rail), followed with a name change to CN North America. Both railroads' changes are reflective of the historic cross border economic pattern that NAFTA formalized.

Under discussion is the General Agreement on Tariffs and Trade (GATT), with 117 of the world's nations involved. The purpose of the agreement is to achieve a new set of "fair trade" rules. The U.S. is generally in favor of the purpose because significant lowering of tariffs is expected. The real problems of the U.S. trade imbalance are believed to be in the non-tariff barriers erected in many countries, particularly Japan and China, to foster growth and protect their own businesses. Regardless of these barriers, GATT should be good for transportation because lower tariffs mean more shipment of goods.

After NAFTA, the western hemisphere's free traders now talk of an American Free Trade Area (AFTA)—a gradual hemispheric free trade area. The expectation of gradual movement is because of the concern over the financial stability of many Latin American countries, i.e., those south of Mexico and the Caribbean Islands. Colombia's President Gaviria looks for AFTA by 2000, and as the new head of the Organization of American States (OAS) he may be in a position to become the hemisphere's champion. INPUT believes that the extension of the free trade area will make sense in the longer term. Prerequisites include: AFTA countries must attain a modicum of financial stability; NAFTA fears must prove to be generally unfounded; and there must be a resolution of the Cuba-U.S. impasse. Of course, Latin America may feel that the U.S. should heal itself financially before a hemispheric partnership can be built.

### c. Technology

Can the U.S. transportation sector firms effectively use their superior technology to extend globally? In railroads, Santa Fe has sold its control

system to Canada's CN North America. Union Pacific achieved a similar arrangement with FNM, Mexico's National Railroad. This is technology sharing previously unknown in transportation and provides a close linkage between the partners as well as income to the seller. INPUT believes that this will become a pattern for other U.S. transportation technology leaders.

The U.S. Department of Defense has opened its satellite-based Global Positioning System (GPS) to the world. Its accuracy is expected to improve airline and ocean navigation, allow the worldwide locating of equipped shipping containers, be part of dispatch-to-truck communications, and even provide data for more accurate maps. The transportation downside is that other government-supported navigation, like Loran C and Omega, may become early victims. However, those producing GPS equipment will find the market exploding, particularly to support the millions of weekend sailors.

Automatic equipment identification (AEI) tags are being attached to freight transportation components, from locomotives to truck trailers and containers, at a rapid pace. The tags will allow road, rail and water carriers to accurately track movements as tagged equipment passes by stationary interrogator units. Railroads are the most aggressive in AEI, with an American Association of Railroads (AAR) mandate to tag all equipment that moves interline (i.e., on more than one railroad) by the end of 1994. This alone will tag over 1.5 million pieces of equipment.

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# Information Systems Environment

## A

### Global IS Issues

As in all industry sectors, transportation has objectives that are technology driven or technology enabled. Some are to catch up with the competition and others are designed to create an advantage, at least temporarily. Now, more than ever since the invention of the wheel and the domestication of animals, transportation sector players are working together—even across mode lines. Exhibit IV-1 lists the primary issues that IS must confront.

Exhibit IV-1

#### Global IS Issues

- Focus on customer service systems
- Achieve apparently seamless services
- Lower operating costs
- Respond to government actions

Transportation sector firms have traditionally had a focus on operations and have often lost sight of their role in serving customers. Even the trucking companies, which get the highest service grades from shippers, are not immune from having more concern for tires and fuel than a customer's needs. Although transportation operational systems are still significant, IS is being asked to build systems that are more shipment oriented. These different systems ideas often require a business feel that may not be present even among the business people of the transport

company. This has tended to make outside help for these system developments a requirement.

As the frequency of being both customer of and shipper to other transportation firms increases, the need for better and more timely communication of information also increases. This is particularly true since the company in control of a shipment may be buried deep within transportation layers far from the true shipper. A continuous flow of information, as in electronic commerce, is often the only way to keep things moving and provide customers with any real shipment data. Some transport companies try to acquire the pieces to do it all themselves, thus creating megacarriers. Even this extreme action does not always solve the communication problem because it is only a collection of different mode-based companies. The creation of seamless transfer through a chain of transport suppliers is an issue even for the megacarrier.

In the price-competitive transportation marketplace, cost reduction has been part of the justification for all but government mandated actions. Even in mandated situations, the complaint of increasing costs often slows implementation, e.g., positive train separation's linkage with ATCS. However, technology as the enabler of cost savings is the mover of projects, as when the cabooses and brakemen at railroads were replaced by the end-of-train box.

Finally, transportation IS has to contend with the action of government and unions more than most industry sectors. Though many would argue that the changes are valid and necessary, their creators claim that they should be allowed to regulate themselves. These mandates can take the form of the unbiasing of CRS systems and the realignment of radio frequencies, which will cost rails dearly.

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## B

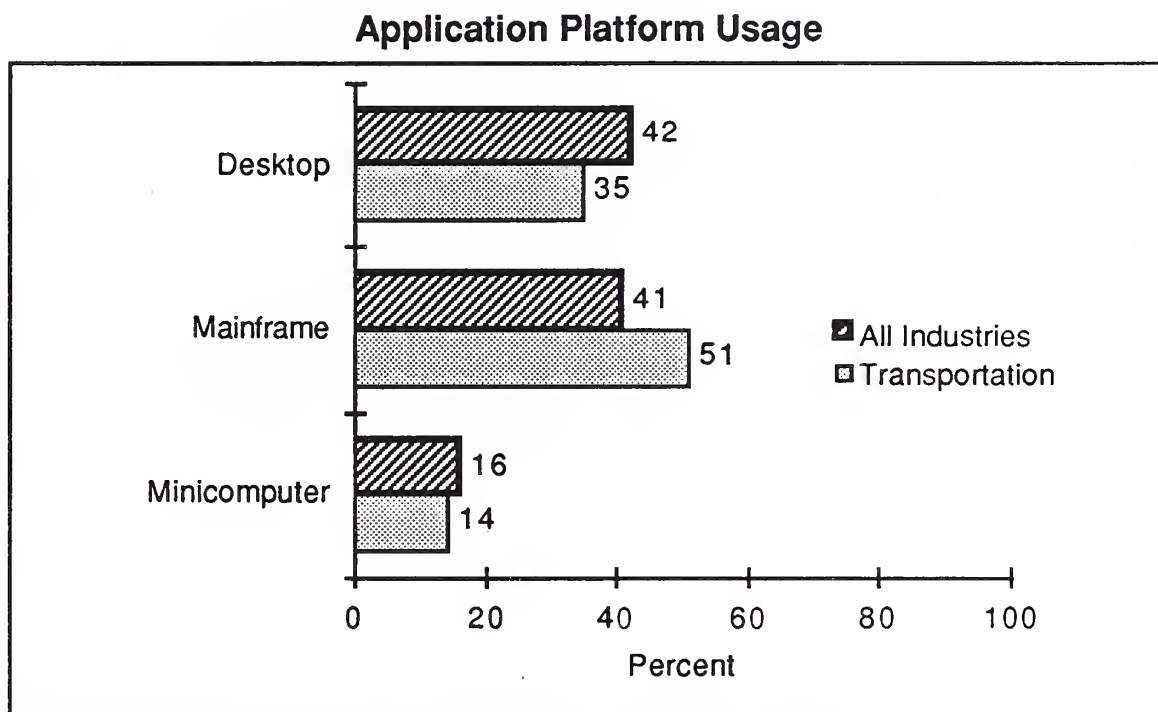
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### IS Applications Environment

INPUT has created and maintains a database containing application system projects collected through questionnaire responses and interviews with project managers at various businesses and government agencies within the U.S. The data is current, having been collected during 1993 and early 1994 as part of INPUT's continuing process of data gathering to support its goals related to the delivery of up-to-date market information. The full base contains information on more than 2,500 application systems divided by standard industry sector classification (SIC codes). Relevant to this research study is the material extracted concerning transportation sector firms, as compared with the entire database.

Exhibit IV-2 compares application platform use between all industries and the transportation sector.

Exhibit IV-2

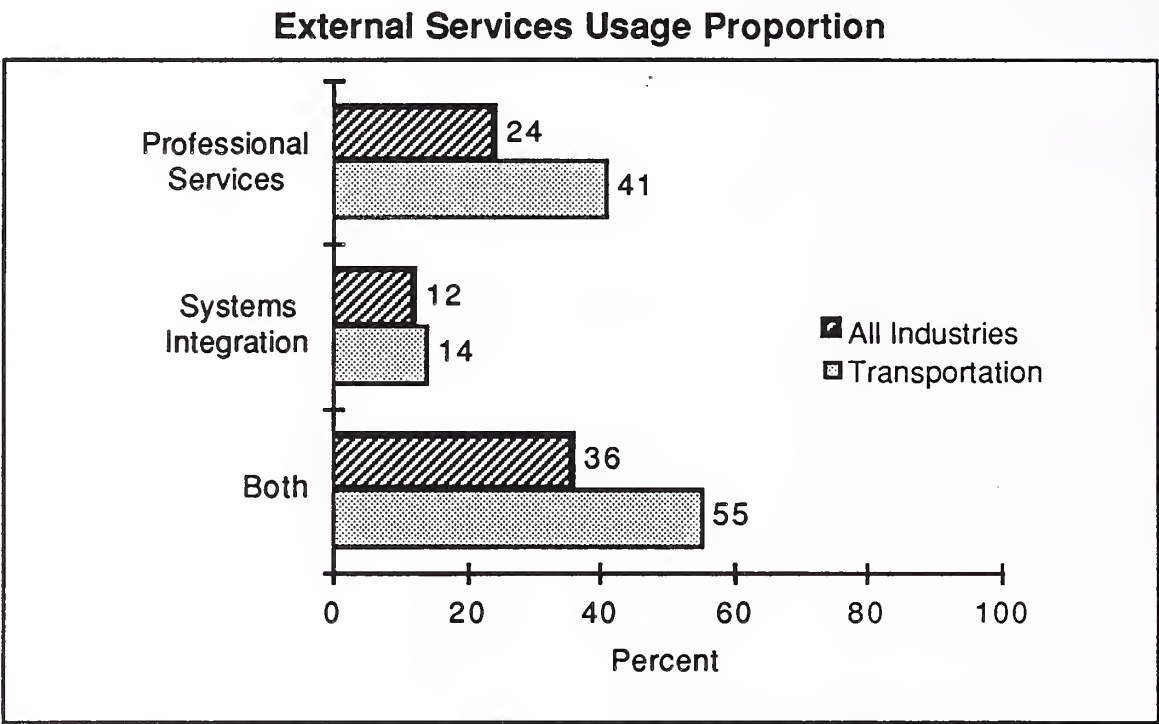


*Because of rounding, numbers do not add to 100%*

Analysis of this data shows that transportation sector application projects tend to be significantly more mainframe based than the average of those for all industry sectors in INPUT's sample. INPUT believes that the main reason for this relates to the substantial numbers of large firms within transportation that have been involved with computers for decades. These would include airlines and major railroads that have been major computer users since the 1960s. This, combined with established information services organizations, supports the favored status of mainframe solutions.

To provide a picture of the use of two particular service markets within the transportation sector, INPUT did an applications sample analysis of professional services (PS) and systems integration (SI) vendors. Combined, these are two of the primary support functions related to application development. Exhibit IV-3 shows the use of these services, comparing the usage of the full sector database with transportation sector applications.

Exhibit IV-3

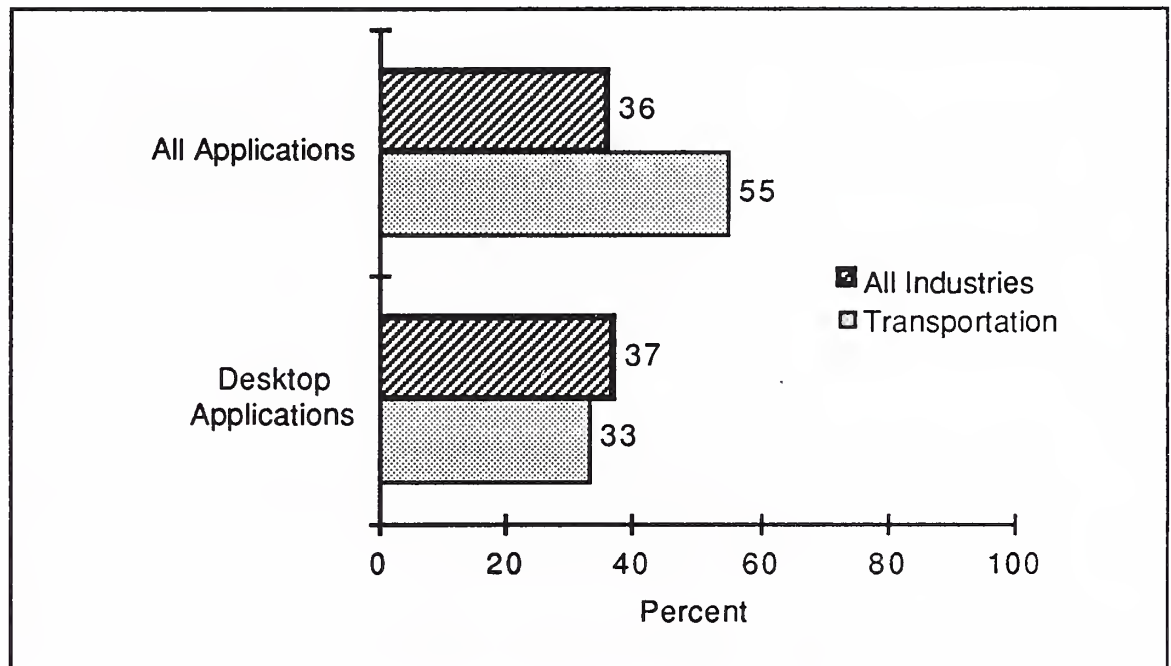


Transportation sector firms tend to use external service support for their application projects much more frequently than the average of all sectors. INPUT's application projects sample shows that 55% of all transportation sector projects involve either professional services or systems integration contractors. This shows that transportation firms know that they are in need of external expert advice and assistance with application systems. This should place this sector's firms among the targets for the vendors of these services.

Finally, INPUT analyzed the use of external services for desktop systems. Desktop systems are those in which the application is implemented on a client/server or workstation processor. This definition would not eliminate the existence of a mainframe within the network, but these solutions require that the processing be done within the desktop environment. Exhibit IV-4 shows the results of this analysis in all industry sectors and in the transportation sector.

## Exhibit IV-4

## Use of External Services with Desktop Systems



INPUT analyzed the impact of desktop systems on the normal patterns for a sector using external services. On average, the total base of projects showed little difference in the use of these services for desktop applications (36% overall, 37% for desktop solutions). However, when viewed by industry sector, some surprising differences were obvious. No industry sector displayed the average. Some sectors became much heavier users, while others showed a tendency to use fewer external services with desktop systems. The transportation sector was one of the latter; use dropped from 55% to 33%. Certainly this sector's lower-than-normal use of desktop solutions for application projects (Exhibit IV-1) is matched by this result. However, INPUT believes that the primary reason is the high level of PC-based turnkey packages created to solve generic transportation issues. An example is the need for all players to become involved in EDI to effect seamless transfers and the availability of inexpensive PC software to meet this need.

Although INPUT believes that the variation between companies may be a better predictor of opportunity than total sector analysis, the tendencies shown for a sector can be valuable to vendors. INPUT's current analysis of the transportation sector shows that mainframe solutions are clearly dominant; firms in this sector tend to be high users of professional services; and, their use of desktop systems tends to be for prepackaged solutions rather than as the application implementation.

**C****IS Response to Environmental Forces**

In most industries, there are firms that break new ground and push forward while the rest of the industry tries to keep up. To some, this has come to mean the application of technology to industry problems in innovative ways. In the 1960s, the technology definition for airlines came from the pioneering SABRE reservation system of American Airlines. Not only did this establish a new expectation for service, but it made airlines one of IBM's largest customers for decades and created the CRS industry.

The most common application found in INPUT's sample of projects active during 1993 hardly qualifies as a new innovation. Rather, it is an indication of a major effort by transportation to implement an existing concept—EDI. No discussion of transportation technology would be complete without an explanation of where transportation is going with EDI.

**1. Electronic Data Interchange**

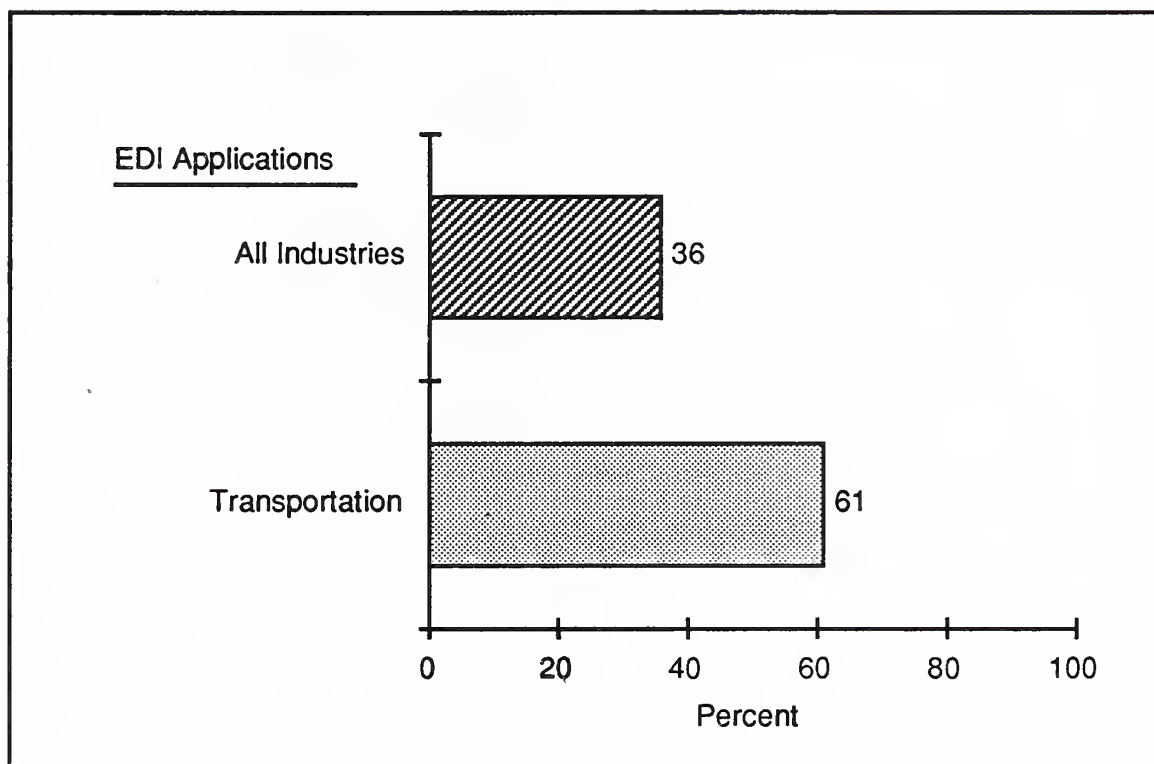
The glue that allows transportation to function and that has improved efficiency is electronic data interchange (EDI). Projects at almost all but the smallest sector companies are in the process of adopting or expanding EDI capabilities. Many times this is to keep business rather than attract it.

Transportation firms, which could have extended the lead they once had in the implementation of EDI, are now frequently doing EDI at the insistence of firms in the other industry sectors they serve. This is not to say that transportation firms are not heavily involved in EDI processing. Rather, the transportation sector's expenditures for electronic commerce constitute about 18% of the total spent by all industry sectors.

However, transportation is working hard to implement EDI applications.

Exhibit IV-5 presents an extraction from INPUT's sample of those projects indicated as having an EDI component. Shown is the percentage of projects for all sectors and those within the transportation sector.

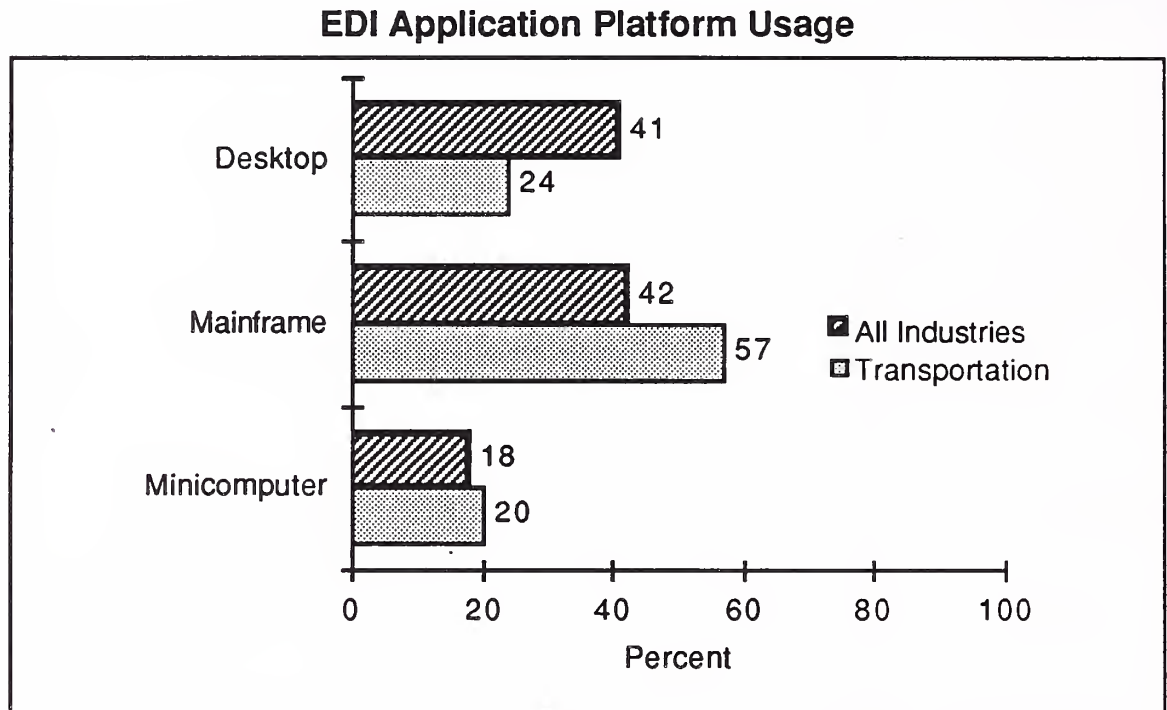
## Exhibit IV-5

**Applications That Include EDI Component**

In INPUT's sample, transportation showed the highest percentage of any other industry sector with regard to EDI; 61% of projects are EDI oriented. This is particularly significant when compared with the 36% average found for the entire sample of projects. Whether the sector's impetus is derived from its customers' pressure or participants' own desires, transportation is moving rapidly on EDI.

INPUT performed an analysis of the platforms used by respondents for EDI application implementation. Exhibit IV-2 showed that transportation applications exhibited a much higher use of mainframe platforms than the percentages shown by other sectors. Exhibit IV-6 compares the implementation platform percentages for the entire INPUT sample to those indicated as within the transportation sector.

Exhibit IV-6



*Because of rounding, numbers do not add to 100%*

Analysis of this data shows that more than half of the transportation sector's EDI application projects were on mainframes. This exhibit is comparable to Exhibit IV-2, except that transportation's preference for mainframes is even stronger with EDI projects. This is in contrast to the generally high use of desktop environments for EDI exhibited by the overall percentages.

In summary, transportation sector expenditures for electronic commerce are percentage-wise lower than in many other industry sectors. Secondly, EDI appears to be an IT application priority within transportation. Finally, transportation shows a high use of mainframe EDI relative to the overall sample. INPUT believes that 1993 application development levels for EDI will continue for several years until transportation EDI expenditures reach or exceed parity with those of other sectors. In addition, INPUT believes that transportation will alter its mainframe preference to favor client/server environments as IS departments become comfortable with that technology. This platform shift will probably be accompanied by an increased need for external services (specifically PS and SI) at the desktop and client/server levels, which is not the current trend.

### a. Rail

Most major railroads have centralized their dispatch and control operations. Union Switch & Signal, in Pittsburgh, has two; CSX and Union Pacific installed one for Burlington Northern. Santa Fe and Southern Pacific used Digital Concepts for their central sites. Although the sites are expensive (UPs cost \$50 million), their annual savings in reduced locomotive idle time alone provide a rapid payback.

Pressure to move forward on the Advanced Train Control System (ATCS) continued from the National Transportation Safety Board, particularly the planned feature called "positive train separation." The full ATCS system proposes that trains be controlled from central computer sites, rather than by the engineer in the cab. The Canadian government has pushed Canadian railroads even harder, but CP Rail has been trying longer and harder than anyone else and has yet to make it work. The crusade for this feature began in 1986 and railroads believe that it can be provided without the massive systems that will be required for the full ATCS.

A future issue for railroads involves a change in the radio frequencies by the Federal Communications Commission planned for 2004. The equipment to effect this change is expected to cost in excess of \$1 billion.

Also in rail:

- Santa Fe's new customer-oriented systems answered the system requirements for CN North America so well that the latter bought a copy of the system. CN North America is owned by the Canadian government. This places two of North America's major railroads—with combined revenues for 1992 of \$6.3 billion—under the same system. The Santa Fe system is mainframe based, using IBM's DB2 relational data base consisting of four on-line applications that focus on the way bill, a railroad's document that specifies the customer order. The system also allows the railroad's customers on-line PC access to shipment information. Santa Fe says that it is in negotiations with another railroad for its system.
- Conrail's ACCESS system does EDI for the railroad's customers and can provide real-time shipment status reports. The system is PC-based and connects to Conrail's mainframe for data. Atlantic Container Lines and Hershey's Chocolate, USA were early users. The primary advantage, according to Conrail, is the quicker billing time provided by the system.

- Union Pacific has re-engineered its decision support systems, e.g., fuel costs and train schedules, into a large parallel processing system based on an NCR 3600 and a Teradata mainframe. The system functions in a client/server environment.

#### **b. Water**

The major 1994 systems story in the water subsector is Ocean Carriers Electronic Access Network (OCEAN). The system is the culmination of an effort that required the U.S. Maritime Commission to allow the ocean carriers to act together through the Information Systems Agreement (ISA). The ISA members include American President Lines, A.P. Moller-Maersk Line, P&O Containers, Sea-Land (part of CSX), Crowley American Transport, Hapag-Lloyd and Orient Overseas Container Line. These firms established or joined the group to unify and standardize EDI and other transmissions for their subsector. The result is a PC-based EDI package created to ISA specifications by TSI International. Expectations are for the system to clear beta test by late 1994.

Synchronous Planning and Real-time Control System (SPARCS) is a Macintosh-based system from Navis of Oakland, CA. It provides enhanced planning for the loading and unloading of ships at American President Lines and Matson Navigation. The system is being expanded to integrate logistics with truckers and customer service and to eliminate many of the formerly manual operations.

#### **c. Truck**

RoadRider is the result of a four-year joint development by JB Hunt and IBM. The truck-cab end of the system is a ruggedized, touch-screen IBM PS/1 with the capability to utilize three different communications links via radio or satellite to the company's centralized headquarters. The system is designed to provide continuous location and status information for dispatchers as well as onboard capabilities. Data entered by drivers is immediately available to dispatchers, rather than by the old way of telephone communications. Hunt estimates that even with only a third of the trucks on line, truck utilization is up 5%, phone costs are down 60% and fleet managers can do their jobs rather than answer driver phone calls. The system is said to provide the support for the service required by JIT auto makers and to consistently meet schedules for efficient intermodal operations.

The package battleground is in the customer's PC, with free tracking software from Federal Express's PowerShip or UPS's MaxiShip. Though

provided as a way to track packages, most customers use the built-in label printing and reporting capabilities. The future for these could be the ability to track shipments with other carriers. For the package companies, there is more business after the software is installed.

#### **d. Air**

Canada's CRS, Gemini, was the object of long and bitter litigation among the owning parties, Air Canada, Canadian Airlines International (CAI) and PWA Partners. The problem: CAI wanted out so that its partial buyout by American Airlines could be completed. It finally happened; Air Canada reservations are Galileo-Canada and CAI will be a SABRE customer.

The breakup of the Canadian CRS Gemini, with Canadian Airlines International becoming a SABRE customer and the creation of Galileo Canada (to be owned by Air Canada), does not alter the overall processing services market. This split moves some reservations activity to SABRE, and will cost CAI \$115 million in fees, but it does not modify the total CRS activity. However, this does draw to a close the lengthy legal struggle among the former Gemini partners.

Worldspan CRS (TWA, Delta, Northwest and Abacus) contracted with IBM for a new mainframe-based information system to consolidate its travel services into a single system.

American began testing wireless LAN notebook computers for roaming customer service attendants to assist travelers with rebookings when counters get full. American anticipates expanding service to the curbside for baggage checking and boarding passes.

Travelogix and System One (Continental/EDS) began joint marketing a PC product in Canada for travel agents that translates data into CRS formats. The software is available in either Windows or Macintosh versions.

Watch airline seats for faxes, games, news, etc. In-Flight expects more than 500 aircraft (currently American West and USAir) to be equipped with its FlightLink digital phones that include an RJ11 phone jack for data. Southwest offers fax and data on its AirOne phones manufactured by Claircom Communications (a subsidiary of McCaw Cellular Communications), which also counts Air France, American, Northwest and United as customers.

### **e. Air Cargo**

The two largest airlines in Japan, Japan Airlines (JAL) and All Nippon Airways (ANA), are moving to prepare for substantial increases in air cargo volumes. JAL expects nearly 20 times more volume in the year 2000 than it handled in 1990 and is increasing mechanization and robotics use to deal with the increases. ANA is upgrading its cargo support systems by 1995 to enhance its freight management.

## **2. Summary**

Each of these technology events displays some response to the global issues; in some cases more than one is addressed. Exhibit IV-7 repeats the list of global IS issues from Exhibit IV-1 and adds the relevant applications projects to complete the picture.

Beyond the classification of the discussed application events to the issues list, there are other interesting points found in the descriptions:

- The level of mainframe use for major systems is higher than might be expected, like RoadRider, the new Worldspan System and Santa Fe's system.
- IBM is partnered with transportation companies JB Hunt and Worldspan.
- Some systems were, or will be, marketed, such as Santa Fe, Conrail and Union Pacific. This introduces new transportation sector technology vendors.

## Exhibit IV-7

**Global IS Issues and Representative Activities**

- Focus on customer service systems
  - Rail
    - Centralized dispatch and service centers
    - Santa Fe shipment-focused systems
  - Freight
    - Enhanced tracking with AEI
    - Direct customer system interface offerings
    - Direct driver/engineer communications
  - Air
    - Wireless notebook customer service
    - Digital aircraft phones
- Achieve apparently seamless services
  - Freight
    - Expanded EDI and EFT capabilities
    - AEI tracking
- Lower operating costs
  - Freight
    - Reduce idle time
  - Rail
    - Train-based technology
  - Truck
    - RoadRider system
  - Air Cargo
    - Two Japanese systems
- Respond to government actions
  - Air
    - Split of Gemini CRS
  - Rail
    - Pressure for ATCS
    - Radio frequency changes

## D

### Impact of New Technologies

#### 1. EDI Message Formats

The controversy over message formats—EDIFACT or ANSI X.12—rages, but few in transportation seem to be very concerned. In 1987, a committee of the United Nations developed what it called "the only acceptable international standard for EDI"—EDIFACT. North American transportation firms continue to use, as they have for years, the ANSI X.12 code structure. ANSI X.12 is also the predominant code for Pacific

Rim countries. Although the issue would seem to loom large, the easy availability of PC-based translation software makes it insignificant.

## **2. Automatic Equipment Identification (AEI)**

Both the American Trucking Association (ATA) and the American Association of Railroads (AAR) are in the process of implementing the standardized international coding scheme used for location tracking of freight containers and freight transport equipment. There are three basic components of these systems: vehicle mounted transponders (tags), stationary interrogator units (radio reader/transmitters), and the computer systems to collect and utilize the data. The tags are small, normally passive electronic devices that currently are about 2 inches by 9 inches. Two tags, one on each side, are placed on each unit. The tag contains a specific number, unit type, ownership identification and an indication of the vehicle side. Interrogator units are located at fixed locations along railroad tracks, highways and in transfer yards. When activated by an interrogator, the transponders respond with their contained identification data.

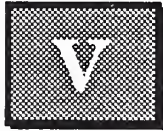
There are seven tag types in all: locomotives, rail cars, end-of-train devices, shipping containers, trailers, chassis and tractors. The AAR has mandated that all interline equipment (that which moves on another company's tracks) will be tagged by the end of 1994. It is expected that more than 2 million pieces of equipment will be tagged by 1995. With two tags per unit, the cost will exceed \$60 million for just the tags. Additional expenditures include interrogator units (\$20,000 to \$30,000 a piece) and communications and software to hold and use the data. Amtec of Dallas is the primary supplier of the tags and interrogator units.

## **3. Communications**

The desire for companies to communicate directly with their dispersed traveling entities (like truck drivers and railroad engineers) has spawned the growth of several competing systems. Some are based on satellites like Qualcomm's OmniTRACS, others on cellular (UPS's multivendor solution), or JB Hunt's hybrid of three different modes. Still others are traditional radio-based systems. One of the most aggressive communications initiatives is the Iridium Communication System, led by Motorola, but supported and owned by many companies around the

world. Iridium proposes the launch of 66 low orbit satellites over the next ten years that will support digital communications to anywhere on the globe through cellular-like phones. The phones are expected to be dual mode, allowing access through terrestrial cellular networks as well as the satellite network.

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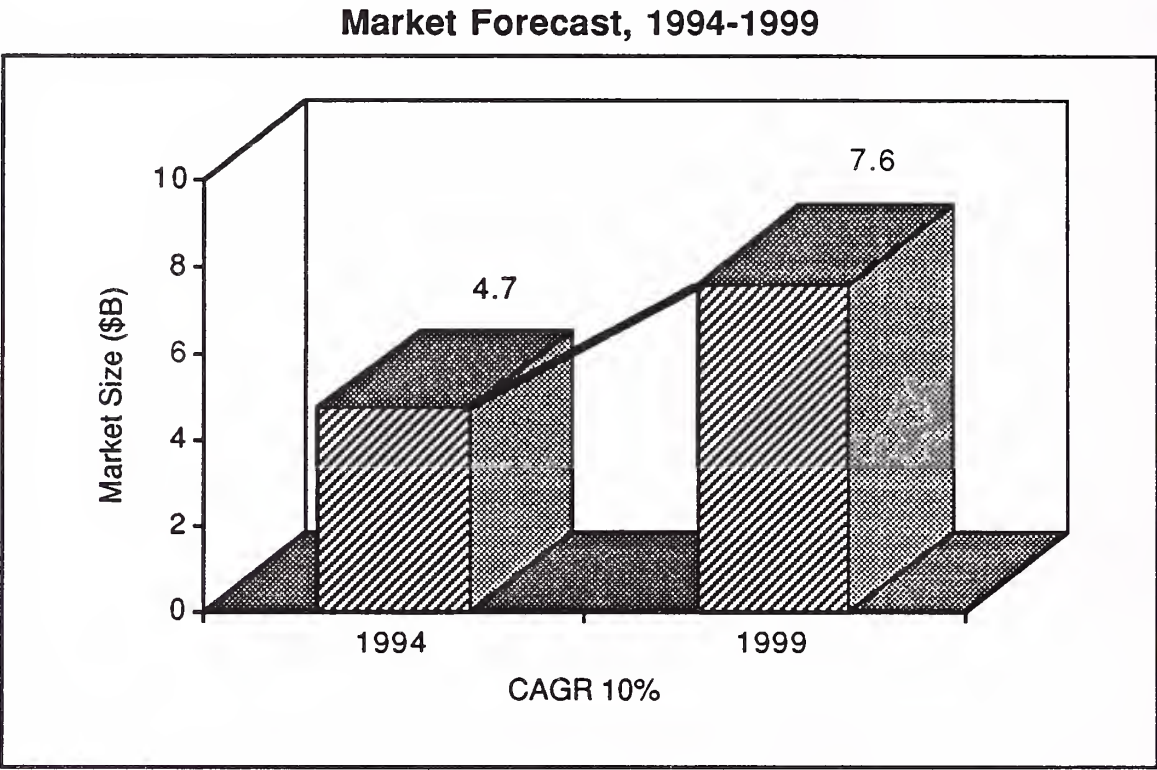
# Information Services Market Forecast

## **A** **Market Overview, 1994-1999**

In 1993, the transportation sector's information services expenditures grew at a 10% rate, consistent with the prior year. In addition, the INPUT forecast for the next five-year period remains unchanged, with an aggregate CAGR of 10%. This year-to-year consistency does not hold in each of the product/service sectors, but the negative shift in some areas is compensated by positive movement in others. The primary change is found in the continued shift from traditional professional services to systems integration. Exhibit V-1 graphs the five-year period.

There is projected growth in all product/service markets through the five-year forecast period. However, the trend of each market is unique and growth diminishes for some (turnkey systems, processing services and professional services exhibit single-digit growth), while dramatic increases are found in others—for example, network systems and systems integration lead with 19% and 20% respectively. Even within a category, some submarkets are on a different track than others; applications software for workstation/PC environments is projected to grow at 22% within a 14% category.

Exhibit V-1



Some product/service markets and submarkets display a cyclic pattern over time, driven up by a new product or service and coming back down as the direct market becomes saturated, a different market offers a competitive approach, or sector spending slacks off. This last can be driven by the poor economic conditions, and the fact that the sector can only sustain so many major technology projects at one time. Seemingly unrelated factors, like government actions, can also affect spending.

**B**

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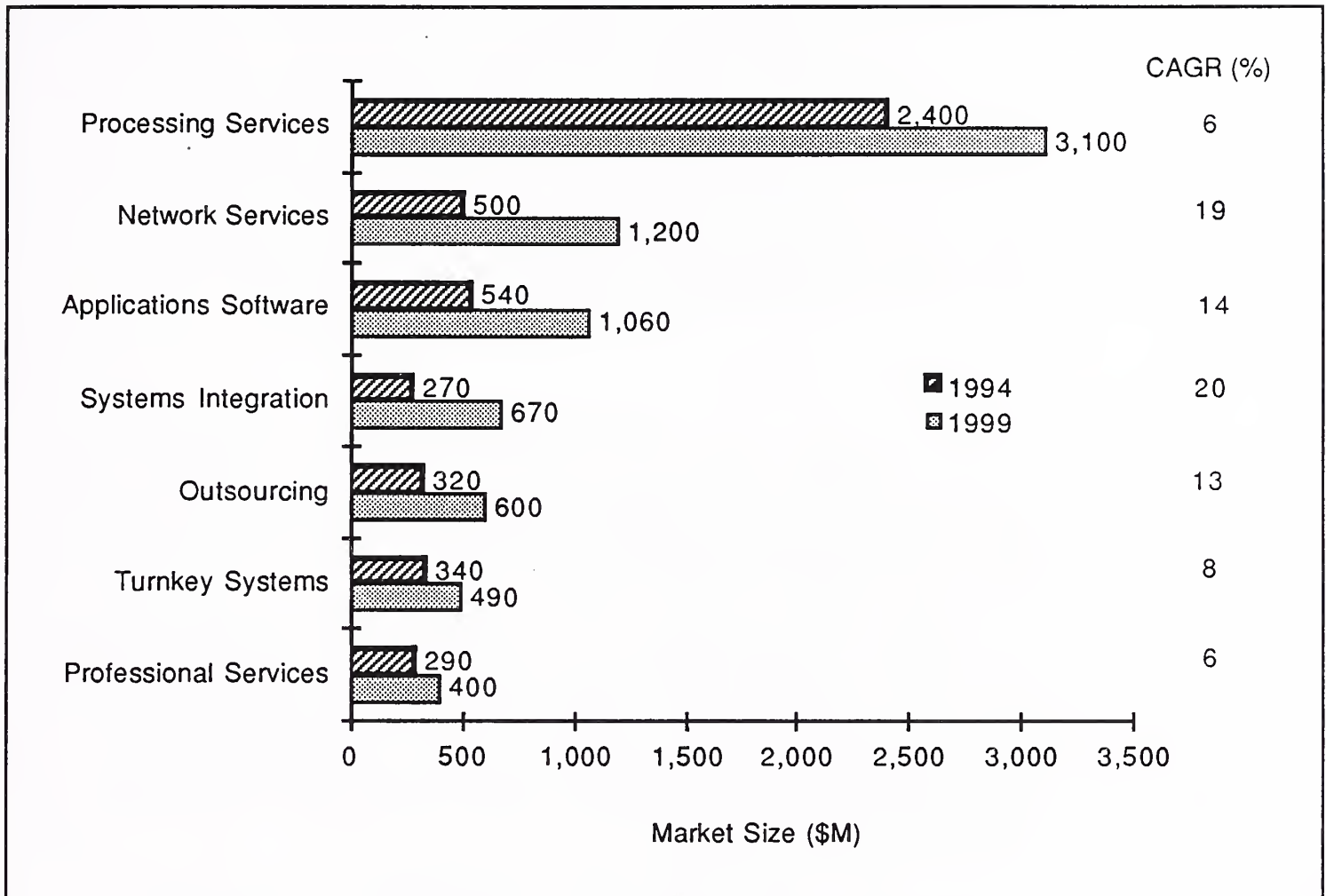
**Forecast by Product/Service Market**

With the exception of the changes previously noted, this year's forecast mirrors last year's in terms of CAGR growth. This stability reflects INPUT's prior forecast for a late 1993 slow-growth recovery, with only single percentage point changes for most markets. INPUT still predicts that this will be the case—a recovery more noticeable in retrospect than as a current event, and that the pace of growth will be generally conservative through the forecast period.

Exhibit V-2 presents INPUT's forecast for the transportation sector by product/service market for the period 1994 through 1999.

Exhibit V-2

## Information Services Market by Product/Service Market



### 1. Professional Services

Expenditures for professional services will grow at a rate of 8% in 1994, with a dollar volume that is sixth out of the seven markets, increasing from \$269 million to \$290 million. The CAGR is forecast to drop to 6% over the forecast period, while user expenditures grow to only \$395 in 1999, as it becomes the smallest product/service market.

Professional services firms' fortunes are tied to the successful conversion to systems integration and outsourcing. Just as the user preference is for application systems, client/server solutions and microcomputers for small systems, the large system projects will go to these more complete services. Though some large-scale projects will always make use of professional services firms for assistance, the competition for other work will increasingly come from other vendor types.

INPUT continues to project that vendors who have historically featured professional services—Big Six firms, niche specialists, etc.—will proceed in the future by featuring systems integration based on their business analysis capabilities. Professional services will diminish as a standalone activity. Smaller firms will move into affiliations that allow them to share in SI projects. Those who remain strictly professional services suppliers will find business as subcontractors in specific niche areas of the sector. Beyond competition from SI firms, the professional services offerings to support turnkey and application systems sales by those firms will also cut into the direct professional services market.

## **2. Systems Integration**

Systems integration, currently the smallest market, is the second fastest growing product/service market, with a CAGR of 20% from 1993 to 1994. The market will grow from \$225 million to \$271 million. This will make SI the fourth largest in total dollar volume.

The growth in SI is predicated on the desire of the sector user to select a single vendor for major systems implementation and the fact that the vendor must commit to risk sharing for the longer term agreement. When successful, both sides win. SI is projected to grow significantly, based on a record of successes and on vendors getting better at selling and executing these projects.

Helping rail and truck segment firms make full use of the information gathered by wireless communication capabilities in vehicles should be an SI opportunity that grows over the next decade.

## **3. Outsourcing**

Systems operations expenditures are expected to show the highest growth, at 36% in 1994, increasing from \$237 million to \$322 million. The two submarkets, desktop services and network management, are projected to grow at 15% and 25% through 1999. The entire product/service market is forecast to grow at 13%, bringing total 1999 expenditures to \$606 million.

The Southern Pacific/ISSC outsourcing contract signed in late 1993 was the primary reason for the year-to-year jump of 78% in the applications operations submarket. The approaches of other bidders (EDS and Perot Systems) were based on re-engineering rather than the more traditional ISSC agreement. The ten-year, \$415 million contract is the first major

outsourcing contract in the railroad sector and may set an example for others, if it is perceived as successful.

Systems operations contracts tend to require lengthy negotiations. They are large in gross dollar volume and extend for a lengthy period. The ability of a systems operator to structure an agreement, take over control, achieve efficiencies and continue to provide quality services is the key to turning initial investments into net profits. INPUT believes that the trend in businesses to strip away all but core units will continue to keep this product/service market busy addressing opportunities through the forecast period.

#### **4. Processing Services**

Processing services showed a 6% increase in transportation expenditures from the 5% recorded the prior year, growing from \$2.3 million to \$2.4 billion. Though improved, this was the slowest growing product/service market this year, a trend that is expected throughout the forecast period. The CAGR from 1994 to 1999 is projected at 6%.

Opportunity exists for this market because of its size. However, the transportation sector is largely made up of small companies at which computers sit on a desktop and basic functions, even rudimentary EDI linkages, are readily accomplished. Even larger players are turning to workstation/PC and network solutions.

The primary application within the processing services market is reservation systems, with the airline CRS systems the predominant entity. The expenditures cover only the revenues for transactions and service agreements, not the expenditures for reservations of the owning airlines. Should airline ownership of CRSs cease, which INPUT believes is inevitable over the next five years, this product/service market would grow dramatically overnight. By way of example: current fees are about \$2 per reservation, with almost 40 billion passengers served by the major airlines annually. Reservation charges could yield an extraordinary expenditure total, even with cut rates for high-volume airlines.

The breakup of the Canadian CRS Gemini, with Canadian Airlines International becoming a SABRE customer, and the creation of Galileo Canada, to be owned by Air Canada, does not alter the overall processing services market.

## 5. Network Services

INPUT forecasts that network services will become the second largest services market very rapidly, probably by the end of 1996. User expenditures are expected to grow by 18% between 1993 and 1994, from \$427 million to \$505 million, making this the third fastest growing product/service market. The CAGR through 1999 will be 19%, with total expenditures exceeding \$1.3 billion during the final year.

The driver is the network applications submarket with expected year-to-year growth of 23%. The primary cause of this growth is the rapid pace of deployment of wireless communications devices by the trucking and rail segments. To support this increase, at least two new communications satellites are expected to be launched in 1994 by the consortium that includes American Mobile Satellite and Telsat of Canada.

INPUT believes that this submarket will grow steadily, but that growth will slow as communications capabilities become saturated. Growth will resume as more capacity becomes available. The growth in this submarket is also a predictor of opportunity in other markets' ability to fulfill the growing need for systems to make use of the new flow of information from vehicles. Location sensing and improved driver/engineer communications are only the beginning as sector firms seek ways to justify the expense of interconnection.

## 6. Applications Software Products

Applications software expenditures by transportation companies will grow at a rate of 14% between 1993 and 1994, with dollar volumes moving from \$427 million to \$544 million. INPUT projects a CAGR of 14% through 1999 as the market grows to over \$1 billion, taking third place among the product/service markets.

Within the submarkets, workstation/PC products maintain an increasing portion of the demand for applications software, growing at a 23% CAGR. Though mainframe and mini submarkets show modest growth, the trend toward microcomputers is at the expense of the other submarkets. Since micro software costs less than mainframe and minicomputer equivalents, this trend also causes the growth in total dollars to be moderated. The workstation/PC submarket's growth is caused by the impact of using intelligent workstations for connection to mainframes, the trend toward client/server, application downsizing, and the need for useful software for vehicle-mounted units.

## 7. Turnkey Systems

Expenditures for turnkey systems increased by 9% in 1994 over 1993, rising from \$310 million to \$337 million. This level is projected to decrease to a CAGR of 8% through the forecast period, reaching \$494 million by 1999.

Though expenditures for turnkey solutions continue to grow annually through the forecast period, the trend toward workstation and PC products will hold the increases to a modest level in this highly competitive market. The trend toward workstation/PC systems could be used by turnkey producers to move products to these machines, which serve to hold down prices. In addition, sector buyers often look for software products to run on existing machines or choose to purchase their equipment separately to achieve the lowest price. This tendency will continue throughout the forecast period as user sophistication improves along with applications software quality and utility.

The slowest growing submarket in turnkey systems is the equipment component, reflecting the growth in workstation/PC systems fashioned with cheaper hardware.

## C

### Analysis

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The trends evident in this product/service market discussion are further borne out by the changes in expenditure share of total sector expenditures projected for each product/service market in Exhibit V-3.

## Exhibit V-3

**Product/Service Market Share Comparison—1994-1999**

	1994		1999	
	(\$M)	Percent	(\$M)	Percent
Sector Total	4,672	100%	7,572	100%
Professional Services	290	6%	395	5%
Systems Integration	271	6%	665	9%
Outsourcing	322	7%	606	8%
Processing Services	2,403	51%	3,145	42%
Network Services	505	11%	1,205	16%
Applications Software	544	12%	1,062	14%
Turnkey Systems	337	7%	494	7%

*Because of rounding, numbers do not add to 100%*

Though all product/service markets show growth through the forecast period, Exhibit V-3 shows the significant change in the share of sector expenditures based on INPUT's forecast.

Losing share are:

- Processing services, the biggest share loser, dropping from 51% in 1994 to 42% in 1999
- Professional services, going from 6% in 1994 to 5% in 1999

Gainers are:

- Network services, with the largest increase, from 10% in 1994 to 16% in 1999
- Applications software, up from 11% in 1994 to 14% in 1999
- Outsourcing, moving up from 5% in 1994 to 8% in 1999
- Systems integration's share going from 6% to 9% in 1999

Only one submarket, turnkey systems, stays at an even 7% share in both periods.



# Competitive Environment

This chapter presents a view of the environment for information services vendors within the transportation sector, in the following sections:

- Competitive Climate
- Competitive Positioning
- Selected Vendor Profiles

INPUT's data is gathered through monitoring published data, in-depth interviews with transportation users, vendors who market to the sector, and published financial data. The data is constantly reviewed, analyzed, cross-checked with alternative sources and updated accordingly. The result is a set of over 3,000 continuously updated files on IS vendors as a basis for extraction in creating sector reports.

## A

### Competitive Climate

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#### 1. Mainframe Bias

Although there exists a shift to client/server- and workstation-based systems, the bigger firms of the transportation sector remain predominantly mainframe operations. This can be meaningful in several ways to the technology vendor. Transportation firms are targets for mainframe-oriented vendors of equipment and services. INPUT believes that they will stay with this direction for their mission-critical legacy systems.

Secondly, as they gradually shift to downsized platforms, their substantial investment in mainframe systems will need to be carefully considered by vendors as client/server development proceeds. An expected requirement will be to integrate legacy and new systems on different platform levels.

Finally, transportation sector organizations will be familiar to technology vendors. With the exception of a few firms, their IS organizations tend to be centralized and traditional in structure. Although this would seem to be contradicted by the next point, transportation firms often buy technology through their IS organizations.

## **2. Transportation Expertise**

Vendors with true industry expertise have the edge in the transportation sector. Transportation executives are not impressed by just Big Six-type credentials and look for a proven industry track record. This is evident in the success of transportation companies as technology vendors. In any industry, how many \$50 million software packages are sold, like the Santa Fe system was to CN North America?

The most effective solution is the building of affiliations with transportation credentialed firms. This does not necessarily mean firms that focus exclusively on transportation. It could also be those with a substantive business in transportation based on their technology niche, such as fuel control systems or EDI.

## **3. Electronic Commerce**

Much of transportation is being pressured to install technology hardware, like AEI, that in aggregate is very expensive to the transportation sector. As technology vendors know too well, the equipment is less than half of the story. INPUT believes that the tracking promised by the attachment tags will require significant expenditure for promise fulfillment. This expenditure will fall first on the owning firm to provide the wide access to this information to be effective in providing customer advice.

The result will be an additional reason for rapid expansion in EDI capabilities by all parties. This will include the addition of new message structures to existing software and increases in the flow of transactions over the networks.

## **4. Integration**

Like all companies, transportation has its share of disconnected systems in need of interfaces. The real issue is the integration of the data soon available from AEI and direct driver/engineer communications within the systems and operations of the companies. Although electronic commerce will provide the means to locate and communicate this data, the next

stage is to actually use this information for decisions, maintenance and enhanced control of assets and people.

It is INPUT's contention that significant systems integration assistance will result from this coming need area.

## B

### Competitive Positioning

Though the majority of vendor names are familiar, particularly to those functioning within the transportation sector, what differs in the transportation sector is the relative importance of the various product/service markets evidenced by their revenue generation.

#### 1. Systems Integration Market (SI)

Exhibit VI-1

#### Systems Integration Vendors

Vendor	U.S. Market Share (percent)
ISSC	20
SAIC	18
EDS	8
Andersen Consulting	6
SABRE	4

INPUT believes that there is significant opportunity for SI firms in the transportation sector, primarily because of the projected growth. Additionally, much of the market (44%) is scattered among many players.

ISSC is the leader in transportation SI, primarily driven by the sector's mainframe history. SAIC, because of its substantial government contacts, has garnered a significant share. Most of its effort is in supporting all levels of government on IVHS (Intelligent Vehicle Highway Systems) and toll collection facilities.

The relatively small shares of major SI vendors EDS and Andersen are testament to the difficulty posed by limited industry exposure. In addition, many big SI players tend to place their marketing efforts in

sectors in which they perceive the most business potential exists—which historically has not been transportation.

Systems integrators can prosper if they can develop the means for their clients to cost effectively utilize the data generated by the expenditures for tracking equipment. A vendor’s capability to support business re-engineering and produce complete solutions will be advantageous.

2. Outsourcing Market

Exhibit VI-2

Outsourcing Vendors

Vendor	U.S. Market Share (percent)
ISSC	18
EDS (non-CRS)	4
SAIC	3
Affiliated Computing	2
RAILINC	2
Litton	2

Until 1993, outsourcing had not been as substantial a factor in transportation as in other sectors. INPUT believes that this has been caused by sector structure and culture. Structurally, transportation is made up of a few very big firms and a multitude of small companies. The large firms have been running their own systems operations almost since the advent of the computer. Small firms did not have this need until the era of the microcomputer. Culturally, the megafirms have seen the computer as a competitive tool, rather than the backroom automation enabler that is the mirror of those at other sector firms. In 1993, both of these barriers were broken by ISSC.

ISSC acquired the outsourcing contract for Southern Pacific Rail, the first major such contract in the railroad industry. The ten-year, \$415 million deal includes application development, disaster recovery, new technology implementation and systems operations. This contract enlarges the previously modest lead of ISSC in transportation sector systems operations.

INPUT believes that things will continue to change in a positive direction for the outsourcing product/service market. A single contract like ISSC's with SP Rail has a big impact on such a small service market and it has the potential to generate more interest in outsourcing within the transportation sector.

### **3. Processing Services Market**

The overpowering product/service market is processing services, which is primarily driven by the now 30-year-old airline CRS systems. The presence within this industry of these pioneers of technology, and the size of these systems, is unique in U.S. industry sectors. This particular product/service market, though dropping in share (from 51% to 42%), is important to vendors because of the potential opportunities from anticipated moves by airlines to generate capital or spread their expense by selling at least some of their interests.

Currently only one CRS system, System One, has even partial non-airline ownership. With that exception, and American's sole ownership of SABRE, all CRS systems are owned by consortiums of airline owners. These systems have really become almost a utility that provides travel agents, corporate travel departments and the public with the automated means to examine schedules, check prices and make reservations. Although the systems are the primary source of reservations to airlines (greater than 80% of their reservations), they have become fairly generic and are more a utility than an offering giving any airline significant market advantage. This last is proven by the success of Southwest Airlines, which prospers without being part of any CRS systems. Exhibit VI-3 shows the major CRS systems by number of travel agent locations.

**Major CRS Systems by Number of Travel Agent Locations**

Vendor	Locations	Percent
Galileo International	30,400	30
SABRE	22,000	22
Amadeus	18,900	19
Worldspan	11,350	11
System One	8,000	8
Others	10,000	10

*Source: Galileo International Market Research*

Galileo International is believed to be the largest CRS worldwide, but American's SABRE is the biggest within the U.S. Although Amadeus, owned by several European carriers, has more locations, Worldspan supports double the terminal base. Abacus (owned by nine Asian airlines) runs in the same Atlanta facility as Worldspan. System One, operated for Continental by EDS, is the fifth largest CRS. The others, in order of relative size, are Axxes—Japan Airlines; Abacus—Asia; Fantasia—Australia; and Infini—All Nippon Airlines.

The demise of Canada's Gemini CRS had little affect on the CRS terrain. Because the former Gemini locations will now function as part of the Galileo conglomerate, where they were prior to Gemini's demise, the locations numbers have not changed.

INPUT believes that further compression of these systems will occur before too long. Additionally, it is likely that American Airlines will sell at least part of SABRE by 1997. This will be expensive, so there are not too many potential bidders.

**4. Network Services Market**

A significant portion (about 25%) of the sector's network services market is for EFT. Based on INPUT's analysis of 1993 EFT application development in transportation, there will be increases in these ongoing support services for the added EFT traffic. Although EFT does not always travel on commercial value-added networks (VANs), a portion

does utilize these suppliers. Exhibit VI-4 lists the major VAN suppliers and their percentage of EFT-oriented expenditures.

Exhibit VI-4

### Network Services Market—Transportation EFT

Vendor	U.S. Market Share (Percent)
General Electric Information Services (GEIS)	28
RAILINC	20
Kleinschmidt1	4
Sterling Software	7
TransSettlements	4
ADVANTIS	3

GEIS should be no surprise in the top position, since it is the U.S. EDI network services leader. GEIS's presence is significant in all transportation subsectors. RAILINC, an AAR subsidiary, is second, with most of its business in railroads and their partners. Kleinschmidt's primary subsectors are rail and trucking. Sterling's full set of electronic commerce products and services includes a significant number of transportation firms. TransSettlement's focus is the growing trucking subsector.

ADVANTIS, created by the recent combination of Sears and IBM, is expected to increase in significance in the future. IBM's outsourcing deal with Southern Pacific Lines and partnership with JB Hunt on RoadRider should give it an interesting entree to network support.

Transportation sector firms also provide support for their trading partners with EFT. Some of these firms are American President Lines (APL), CSX and Union Pacific.

**C****Selected Vendor Profiles****1. TSI International**

45 Danbury Road

Wilton, CT 06897

Phone: (708) 761-8600

President & CEO: Constance F. Galley

Status: Private Corporation

Total Employees: 150

1992 Revenues: \$10 to \$20 million\*

\* INPUT estimate

**a. General Description**

TSI International, founded in 1967, develops and markets software products for IBM mainframes and PCs focused on solutions for the delivery of data to production systems. In 1978, TSI introduced the KEY/MASTER data input software system, which became the leading system of its type. In 1989, Warburg, Pincus Ventures chose TSI for its financial support in the development of an EDI product. The result of this capital infusion was the Trading Partner mainframe EDI translation software product, introduced in 1990. In 1990, TSI also acquired the license and customer base for TransSettlements' TransSlate EDI package, and Foretell Corporation, the marketer of PC-based translation software.

**b. Products and Services**

Approximately 40% of TSI's revenues are based on its EDI mainframe and PC products, with the remaining 60% from its industry standard KEY/MASTER products. TSI has kept to its core business of software sales and its acquisitions have fit this model. Its long history in EDI has brought it into contact with transportation companies, though often as part of a contracts with shippers, like Wal-Mart.

Specific EDI products include:

Trading Partner, a mainframe-based EDI management software package that can process all varieties of EDI messages and map them to a client's applications.

Trading Partner PC, the first Windows implementation of an EDI translator, supports most network interfaces and handles all standard

EDI formats. Also available are a line of "kits" for spoke companies to major hub shippers, e.g., Sears and Allstate Insurance. Many more are in the process of development.

TransSlate, an EDI translation package for all platform levels, licensed from the network operator TransSettlements.

### **c. Strategy**

TSI has traditionally sold its EDI management ideas and software to major trading companies (hubs) then proceeded to assist its supplier companies (spokes) with connections. The largest of these has been Wal-Mart, with at least 1,500 suppliers. This strategy is effective because one major sale begets multiple opportunities, many of them within the transportation sector.

The direct transportation project OCEAN for the major U.S. ocean carriers is really similar to TSI's basic hub-and-spoke approach. OCEAN is the creation of Trading Partner sets to fit the specific needs of the ocean carriers. The only difference is that the carrier's hubs will be spokes to other hubs.

In addition, industry experts suspect that TSI may be close to the marriage of its two product sets, manual and electronic data entry. This would open its large Key/Master client base to easy addition of EDI capabilities.

### **d. Challenge**

TSI has historically not been involved in the operation of communication networks. In one respect this has been a blessing to its bottom line, because few companies make much money from their EDI network operations. The converse of this could present TSI problems because its competition can provide full EDI services. Because of the first issue, TSI has been more successful financially.

## **2. Galileo International**

9700 West Higgins Road

Rosemont, IL 60018

(708) 518-4000

President & CEO: Allen Z. Loren

Status: Private Corporation (Ownership = 50% by three North American carriers/50% by eight European carriers)

Total Employees: 2000 +

1992 Revenues: Not published

### **a. General Description**

Galileo International was formed in September of 1993 by the combination of Covia Partners (Air Canada, United Airlines and USAir) and Galileo (Aer Lingus, Alitalia, Austrian Airlines, British Airways, KLM Royal Dutch Airlines, Olympic Airways, Swissair and TAP Portugal).

The early heritage is found in the United Airlines Apollo Reservation System, which began service for that airline in 1971 and became the second (American's SABRE was the first) to place terminals in travel agencies, in 1976. Although most individual airline reservation systems were capable of "interline" reservations prior to the existence of travel agent terminals, it was this placement that is registered as the official beginning of the CRS (computerized reservation system). It was also during that period when airlines' reservation systems were connected for reservation feed to other travel service companies' systems, e.g., car rental and hotels. This system eventually became Covia, a separate affiliate of United, then Covia Partnership, with half ownership sold to four European airlines plus USAir. At the same time, Galileo was being developed jointly by a group of three European airlines plus Covia, which was joined by five other European airlines. In 1989, Air Canada, part owner of Canada's Gemini CRS, became the seventh Covia partner. In 1993, the two separate CRS systems were brought under a single operating center near Denver, Colorado. Finally, in 1994, Galileo International took over the operation of Air Canada's Gemini CRS.

In reality there are three distinct CRSs and one shadow CRS within one operating center: Apollo, Galileo, Gemini and Southern Cross, but these appear to the travel agent as one CRS.

Self-described as one of the world's largest non-government data centers, Galileo has a massive operation that includes:

- 23 mainframe CPUs: 19-CRS operations; 2-RoomMaster, CarMaster, Leisure Shopper products and communications management; 2-testing and E-mail. Combined processing capacity is 1,120 MIPS.
- 3,750 disk drives, with 4.8 terabytes (trillions)
- 348 tape drives and three tape silos (library of 135,000 tapes)
- Combined, the average daily number of transactions processed is 57 million, with recorded peaks in excess of 2,000 messages per second.

#### **b. Products and Services**

Galileo is reputed to be the world's largest CRS, although American's SABRE system has more U.S. locations. The primary function is in supplying travel agent automation. Their standard products include:

- Airline reservation booking at over 450 airlines, providing last-seat availability, carrier-specific displays, guaranteed booking and seat maps
- Focalpoint - Windows-based that allows the CRS access as well as local PC applications
- GlobalFares - an advanced international fare quote package
- RoomMaster - allows access to accurate hotel room information covering 191 vendor companies and 28,000 properties
- CarMaster - allows access to accurate auto rental information for 51 rental companies.

#### **c. Strategy**

Galileo's is a global strategy to be the largest service provider with high-quality service and superior products for the travel agent.

Galileo has established a set of National Distribution Companies in 40 countries to market its products. These are locally owned enterprises within travel-related businesses (many are local airlines) which provides a regional view for local customization of the CRS product and local sales/service force.

Galileo appears to be the model for a CRS structure that is a utility for travel agents, rather than the single airline competitive weapon of a generation ago. Certainly it remains fully controlled by airlines, yet

provides services to an industry interested in the broader travel services business. The future will tell whether this different style of ownership, with its single subsector view, can provide the automation services travel agents require, move beyond the traditional airline reservations bias, and make money.

### **3. Integrated Systems Solutions Corporation (ISSC)**

560 White Plains Road

Tarrytown, New York 10591

Phone: (914) 333-3030

Chairman & CEO: Dennie M. Walsh

President: Sam Palmisano

Status: Subsidiary

Total Employees: 10,274

Total Revenue: \$1.84 billion

Noncaptive revenue: \$657 million

Fiscal Year End: 12/31/92

#### **a. General Description**

ISSC was formed as an operating division of IBM in 1991 and was established as a separate subsidiary in March of 1992. Its original formation was the combination of several IBM services: systems operations, systems integration, consulting, voice and data networking, applications software development, and business recovery services. The primary client (64% of revenues) of ISSC was and remains other units of IBM.

In December of 1992, IBM and Sears, in a joint venture, formed ADVANTIS. This venture was the combination of the two companies networks under a single entity. Although the financial details are unknown, IBM holds the majority interest in ADVANTIS. ADVANTIS network support and operations became part of ISSC in 1993.

In transportation ISSC has had some significant successes:

- In March of 1993, Hertz Corporation signed a five year, \$80 million contract for ISSC to take over operations of IBM-based systems, provide business recovery services, and a majority of applications development.

- In December of 1993, Southern Pacific Rail Corporation signed a ten year, \$415 million outsourcing contract with ISSC - the first for the railroad sector. The contract call for complete IS management including: systems operations, application development, business recovery, and new technology implementation.

In addition to the obvious, this precedent could produce more interest in outsourcing within transportation, enhance ADVANTIS as a transportation industry VAN network supplier and provide ISSC an inside track on other railroad projects, eg. ATCS and AEI.

### **b. Products and Services**

ISSC's products and services are fairly standard: systems and network operations, systems integration, technology consulting, applications development and maintenance, and business recovery services. In fact, IBM has offered most of these services for some time, but not in a unified combination. ISSC feels that this new combination will unleash the inherent potential and create a technology powerhouse.

### **c. Strategy**

The strategy is simple, to establish IBM-ISSC as a world-class supplier of systems operations, systems integration, business systems recovery and network services. Much of this terrain IBM had historically left for others as they concentrated on manufacturing and operational software. This new strategy places them firmly in competition with EDS, CSC, SHL Systemhouse, CAP GEMINI and Perot Systems. Based on IBM's recent financial performance it is doubtful that anyone will cry foul as they did in the 1960's.

### **d. Challenge**

Although ISSC has shown very good results, will they be able to break from the culture and history of IBM to succeed. ISSC was created without their own sales force, which could prove to be a problem. Their entry to customers is only after the regular IBM salesman has identified prospects on product sales calls.

Their traditional outsourcing approach to Southern Pacific against the more aggressive re-engineering approaches offered by EDS and Perot Systems. Will this conservative style of proposal continue to be favored or will it prove to be not what the customer is seeking? The transportation sector may be just the right place for ISSC to prosper.

#### **4. RAILINC Corporation**

50 F Street, N.W.

Washington, D.C. 20001

Phone: (202) 639-5500

President: Henry W. Meetze

Status: Subsidiary

Parent: Association of American Railroads (AAR)

Total: Employees: 130

Total Revenue: \$18,000,000

Fiscal Year Ending: 12/31/93

##### **a. General Description**

RAILINC was founded in 1982 to provide network services for the transportation industry's railroad sub-mode, including: EDI, industry data bases (eg. railcar locations) and software products. Although primary clients include the major North American railroads, RAILINC also provides services to short lines, equipment leasing firms, shippers, other network applications vendors and government agencies. Railroads still provide about two thirds of RAILINC's revenues.

##### **b. Strategy**

RAILINC was established as a for-profit subsidiary of their parent non-profit association. They seek to provide quality services to all areas of the transportation industry.

Although RAILINC is perceived as a captive processing service for the railroad industry they are their data bases and network capabilities are used by other transportation firms and other industry sector firms for railroad information. Client satisfaction has and continues to be rated very high, particularly within their niche market. Competition could be a major future factor from more full service VAN providers, particularly with AEI information pressing their capacity.

The most significant recent event was their RFP sent in late 1993 for an outsourcer to enhance railroad inter-communications, including the creation of a computer network and repository system. The RFP for a network could signal the replacement of Railinc as a major transportation information processor. However, since RAILINC frequently contracts for major development projects, this could be their preparation for increased demand.

### **c. Products and Services**

Network services provides about 90% of RAILINC's revenues, with the remainder from software products.

RAILINC does not discriminate their network applications services from their data base access traffic. INPUT believes that their data bases are the key to much of their transactions.

CLM - Car Location Message service collects transactions from railroads to maintain the base of equipment locations.

Data Exchange System - consolidates equipment hiring and repair information and provides electronic information to equipment owners.

EDI - The RAILINC system provides traditional EDI for over 400 clients.

#### **Data Bases:**

TRAIN II (Telerailed Automated Information Network) is an international freight car data base. Currently over 150 clients use this data that tracks the movement of railcars, trailers and containers via railroad nationwide.

UMLER is a computerized version of the Official Railroad Equipment Register containing information on more than 3 million registered railcars, trailers and containers.

RAILINC also recently added an accident reporting system for access by all railroads. Data is supposed to be entered within 30 days of an accident and is made available to other railroads to avoid prolonged delays in addressing preventive measures.

### **d. Challenges**

RAILINC is primarily a captive processing service for the rail industry. Use by others is generally restricted to communication regarding railroad shipment legs. The advent of more sophisticated tracking (AEI), train control and dispatch could press their capability to keep up. Their new accident reporting system, which shortens the time for accident reporting to 30 days would seem out of place for an industry headed for "real-time" location information.

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## Conclusions and Recommendations

One hundred years ago, in a pre-wired world, transportation and communication moved at the same speed to support the relatively limited trade of that era. Now information moves at light speed and packages move globally from here to there almost overnight. Transportation, communications technology and commerce were and remain bound together.

### A

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#### Industry Conclusions

INPUT's transportation report last year summarized the sector's business future in this manner:

"The key to the sector's recovery is primarily economy-related. INPUT believes that a steady recovery will begin in late 1993. Though many sector firms have learned how to make money in slow times, the whole sector needs a strong economy and year-end 1993 will probably not show widespread profitability."

The prediction was accurate and transportation's deep cost-cutting moves of the recent past made 1993 a good year, although the U.S. economy for the whole of 1993 grew at a modest 2.6%. Transportation's showing was attributable to the firms that have learned to make money even in slow times. The exception in true profits was airlines. Industry experts believe they require a U.S. growth rate of better than 3.6% to universally achieve profit.

The U.S. Department of Commerce predicts U.S. economic growth to be 3% for 1994. INPUT concurs with this estimate for the U.S. However, INPUT believes that the impact of economic globalization should produce a more positive influence on transportation sector firms than would be

indicated by viewing U.S. growth alone. Exhibit VII-1 lists INPUT's conclusions derived from this study of industry trends and actions.

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Exhibit VII-1

### Industry Conclusions

- Global economy improvements will enhance transport's opportunity
- Integration in freight transportation subsectors
- Freight will focus on customers and make operations serve
- The CRS will crease to be an airline property
- Major ocean carriers will force regulation changes

#### 1. Global Economy

The positive impact on global trade caused by the breakdown of barriers will soon be evident and will continue at a greater pace throughout the decade. Within the western hemisphere, the initial impetus is NAFTA—that began in 1994 and will proceed to provide further enhancement as other trigger points are reached over the next few years.

The establishment of a trade block in the Americas, which would exist in a world with several blocks, e.g., Asia and Europe, will not produce the trade improvement promised by the General Agreement for Tariffs and Trade (GATT). This agreement has the potential to intensify global trade and reduce the patchwork of nontariff barriers built to protect a nation's businesses. INPUT believes the benefits of increased free trade will induce improved levels of transportation, the enabler of trade.

#### 2. Integration in the Freight Transportation Industry

INPUT believes that a true transportation industry for freight in North America will emerge. This will be driven by many factors and fostered by the blending of the modes and the technological interconnection of the players. This will be needed to provide the service for customers who wish to become mode insensitive. This blending will take the form of mergers, acquisitions and affiliations. Although the question of which submarket will dominate is open, the customer should win since all are racing to provide seamless movement.

### **3. Freight Will Focus on Customers and Make Operations Serve**

The historical focus of freight transportation has been on operations—like the movement of a rail car to the end of the line. This is changing as more focus is placed on customer needs and supplying operations to support the customer. The Santa Fe system, that has also become the CN North America system, is developed with a base in customer shipments, not railroad equipment. This system is no longer unique in transportation, but is an obvious example of the new era. The level of re-engineering and development that is required presents a substantial vendor opportunity.

### **4. The CRS Will Cease To Be an Airline Property**

Pressure continues on airlines to release their hold on CRS systems. In reality, the only major CRS system that is owned exclusively by one airline is American's SABRE System. Although many other airlines operate their own reservation systems, their presence as a travel agent service is relatively restricted. Other major systems are all owned by consortiums of airlines, except System One, which is partly owned by EDS. INPUT believes that American will sell at least part of SABRE, its very successful CRS system. Further, INPUT believes this will occur before the end of 1996. The price tag will be large, hence the roll of potential bidders is short. Will there be a CRS growth opportunity to support a growth in rail passengers?

### **5. Major Ocean Carriers Will Force Regulation Changes**

American President Lines and CSX's Sea-Land subsidiary have jointly warned they will reflag at least some of its ships. This change in the country of registry would allow it to avoid the restrictive regulations on which it blames its inability to be competitive. The transport companies feel that the U.S. government must either relax the regulations or compensate the carriers for the differences in costs it faces.

The U.S. government has always maintained that a U.S. merchant marine is essential to national security. It argues that in time of war, ships are needed to carry military personnel, equipment and supplies into war zones. The government contends that this could not be assured of a ship registered in Panama or Liberia.

Because the administration is preoccupied, INPUT believes that the two ocean carriers will be persuaded to delay their announced year-end 1994 decision. Furthermore, accommodations will be made to retain them as

U.S. merchant carriers. In the long run, U.S.-registered ships will drop in either case because of business economics.

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**B**

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**Information Services Market Conclusions**

Technology is:

- The enabler of consolidation and seamlessness
- The avenue to added efficiency and cost savings
- The tool for the shippers to exert some control over movements

Technology people who only see these attributes may relearn the mistakes of the past. These have been the selling points of automation since the beginnings of IBM. The very idea of the automated tracking of rail equipment goes back to a 1960s attempt using bar code labels attached to cars and trackside readers. The attempt ended because the labels could not be kept clean enough for reading. Had it worked, railroads could have become the predominant force in freight transportation.

INPUT believes that AEI and EDI present the means to vastly change the fabric of freight transportation. Exhibit VII-2 lists the resulting market conclusions.

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Exhibit VII-2

**IS Market Conclusions**

- |  |
|--|
| <ul style="list-style-type: none"><li>• Technologists must provide business solutions</li><li>• Electronic commerce will be part of these solutions</li><li>• Growth in technology spending will exceed the growth in industry revenues</li><li>• Mainframe systems and solutions are part of transportation</li></ul> |
|--|

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**C**

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**Technology Vendor Recommendations****1. Business Knowledge Is a Key**

Successful technology vendors must have the prerequisite industry experience. Affiliation and acquisition of industry firms may be required to attain this expertise.

INPUT believes that vendors who acquire the needed sector business knowledge and know the technology directions will find considerable demand for their services. Firms already servicing this sector will have an advantage. Sector knowledge is the key, as evidenced by the success of some sector firms translating their technology leadership into identities as SI and SO vendors, even outside their submarkets.

## **2. Electronic Commerce**

A good deal of the implementation pressure for shipment tracking and EDI is from transportation customers. An interesting result of the review of current transportation customers is that they are other transportation service companies. This is primarily due to the fact that the majority of shipments change carriers in transit, as evidenced by the growth in intermodal transport. However, transportation as an industry is often in a reaction mode to the logistically savvy retail and manufacturing sectors.

The Wal-Marts and GEs have come to view logistics, the management of their inventories even while in transit, as critical to success. General Electric has even gone so far as to establish the largest electronic commerce network in the U.S. (GEIS), originally built for internal service. To support logistics and maintain its customers, transportation firms must rapidly evolve the means to support their customers' demands for real-time information.

The hardware and basic software exists and is being implemented rapidly. Making it work without seams, providing inclusion of transport competitors and developing the next levels of systems are post-connection opportunities.

## **3. Spending Growth Is Expected To Exceed Revenue Growth**

As is already clear, expansion of revenue for transportation is limited. Successful vendors will need to understand that transportation firms are committed to technology spending. Internal IS organizations will soon be forced to find cost savings and operational efficiencies to compensate for technology expense.

INPUT believes that vendors will need to lead transportation IS to the benefits even more than in the past. This time technology must fulfill the promise to the business.

#### **4. Mainframe Orientation**

INPUT's research shows a substantive bias toward mainframe solutions. Although this will change over time, vendors should be prepared to support mainframe solutions and integrate legacy systems with their nonmainframe solutions. Those who do, and help IS organizations maintain their prior investments, will do well in the transportation sector.



# Appendix: Information Services Market Forecast and Reconciliation

## A

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### Forecast Database

Exhibit A-1 presents INPUT's detailed 1993-1999 forecast for the transportation sector.

Exhibit A-1

**Transportation—Market Size Forecast by  
Product/Service Sector, 1993-1999**

<b>Product/Service Sector</b>	<b>1993 (\$M)</b>	<b>Growth 93-94 (%)</b>	<b>1994 (\$M)</b>	<b>1995 (\$M)</b>	<b>1996 (\$M)</b>	<b>1997 (\$M)</b>	<b>1998 (\$M)</b>	<b>1999 (\$M)</b>	<b>CAGR 94-99 (%)</b>
<i>Sector Total</i>	4,214	11%	4,672	5,136	5,646	6,218	6,848	7,572	10%
<i>Professional Services</i>	269	8%	290	313	334	357	376	395	6%
- IS Consulting	67	10%	74	81	89	99	109	119	10%
- Education & Training	36	14%	41	44	47	49	54	59	8%
- Software Development	166	5%	175	188	198	209	213	217	4%
<i>Business Integration</i>	225	20%	271	325	390	469	563	665	20%
- Equipment	78	23%	96	117	142	173	203	240	20%
- Software Products	14	21%	17	20	26	31	39	47	23%
- Professional Services	126	19%	150	178	210	251	305	360	19%
- Other	7	14%	8	10	12	14	16	18	18%
<i>Outsourcing</i>	237	36%	322	366	411	465	528	606	13%
- Platform Operations	116	14%	132	147	163	178	195	218	11%
- Applications Operations	76	78%	135	153	168	189	219	253	13%
- Desktop Services	25	20%	30	35	41	47	51	60	15%
- Network Management	20	25%	25	31	39	51	63	75	25%
<i>Processing Services</i>	2,268	6%	2,403	2,540	2,692	2,850	2,995	3,145	6%
- Transaction Processing	2,268	6%	2,403	2,540	2,692	2,850	2,995	3,145	6%
<i>Network Services</i>	427	18%	505	596	719	850	1,013	1,205	19%
- Electronic Info. Svcs	309	17%	360	421	508	595	706	820	18%
- Network Applications	118	23%	145	175	211	255	307	385	22%
<i>Applications Software</i>	478	14%	544	625	700	800	918	1,062	14%
- Mainframe	157	5%	165	173	181	189	197	206	5%
- Minicomputer	124	10%	136	152	163	173	183	196	8%
- Workstation/PC	197	23%	243	300	356	438	538	660	22%
<i>Turnkey Systems</i>	310	9%	337	371	400	427	455	494	8%
- Equipment	147	7%	157	173	183	193	203	217	7%
- Software Products	118	11%	131	145	160	173	187	205	9%
- Professional Services	45	9%	49	53	57	61	65	72	8%

**B****Forecast Reconciliation**

Exhibit A-2 presents a reconciliation of INPUT's 1994 forecast for transportation with the 1993 forecast.

Exhibit A-2

**Transportation  
1994 MAP Database Reconciliation (\$ Millions)**

Product/ Service Market	1993 Market				1998 Market				93-98	93-98
	1993 Market (Forecast) (\$M)	1994 Report (Actual) (\$M)	Variance From 1993 Forecast		1993 Market (Forecast) (\$M)	1994 Report (Forecast) (\$M)	Variance From 1993 Forecast		CAGR per data '93 Rpt (%)	CAGR per data '94 Rpt (%)
			(\$M)	(%)			(\$M)	(%)		
Total	4,162	4,214	52	1%	6,685	6,848	163	2%	10%	10%
Professional Services	266	269	3	1%	370	376	6	2%	7%	7%
Business Integration	222	225	3	1%	539	563	24	4%	19%	20%
Outsourcing	235	237	2	1%	477	528	51	11%	15%	17%
Procesing Services	2,239	2,268	29	1%	2,950	2,995	45	2%	6%	6%
Network Services	422	427	5	1%	997	1,013	16	2%	19%	19%
Applications Software	472	478	6	1%	904	918	14	2%	14%	14%
Turnkey Systems	306	310	4	1%	448	455	7	2%	8%	8%

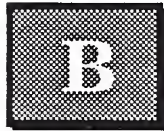
Transportation industry growth has been quite stable over the past few years, since the effects of deregulation in airlines and trucking have modulated. This forecast assumes a slow return to a growing global economy, improvements in the competitive positioning of carriers and a return to U.S. industrial growth and personal travel.

Although the variances in 1993 forecast and actual figures could be very significant to the recipient vendors, they represent modest change

overall. All variations are small, 1% or less with rounding, and are underestimates of IS spending growth.

Only two 1998 modes, systems integration and outsourcing, are significantly changed from the prior report—the rest are modest changes of 2% or less. Systems integration shows a slightly faster growth (1%) over the five-year period than previously expected, while outsourcing has been adjusted (2%) to account for the Southern Pacific Rail outsourcing contract with ISSC.

Finally, the result of the noted upward variances is that, percentage-wise, the industry continues to perform as INPUT has anticipated for the past two calendar years. For now, this relative stability is expected to continue through the forecast period.



# Appendix: Industry Structure, Methodology and Related Reports

Appendix B describes the structure of the transportation industry and explains INPUT's research methodology and the techniques used in the preparation of the forecast data. Section 3 lists the allied INPUT reports that should be used to complete the picture portrayed in this vertical industry report.

## 1. Industry Structure

The transportation industry encompasses all service businesses that are primarily involved in the movement of goods and people. To those who work in these businesses it is not a single industry, but rather a group of competing industries based on their mode of transport, i.e., railroad, trucking, etc. Assigned SIC codes for the transportation sector firms serve to reinforce these mode distinctions, as the primary two digits generally designate mode. The modes are quite different in vision-economic forecast and their use of technology. Therefore, this report will consider each of these "transport mode" entities as segments within the overall sector.

**Sector Definition**—The transportation service industry sectors, as defined by INPUT, include:

- Railroads, SIC code 40, including passenger, general freight and the rapidly growing intermodal traffic
- Local and Interurban Passenger Transit, SIC code 41, commuter transport, generally publicly subsidized, but frequently operated by other sector firms
- Trucking, SIC code 42, for-hire motor freight

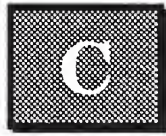
- U.S. Postal Service, the only entity in SIC code 43
- Water, SIC code 44, freight—domestic and international
- Air, SIC code 45, covering passenger and freight—domestic and international
- Pipelines, Sic code 46, covers petroleum lines, and excludes natural gas carriers that are part of the energy industry
- Services, SIC code 47, covering the specialized businesses that include travel agents, freight forwarders, etc.
- Package delivery firms are classed in SIC codes 44 and 45, dependent upon their parentage. For instance, Roadway Express is with trucking, Federal Express is listed as air cargo, etc.

## 2. Methodology

Much of the data on which this report is based has been gathered during 1993 and the first half of 1994 as part of INPUT's ongoing market analysis program. Trends, market sizes and growth rates are based upon INPUT research and in-depth interviews with users in the transportation services industries and the IS vendors serving the industry. INPUT maintains ongoing relationships with, and a database of, all users and vendors it interviews. Interviewees for the research portion of this report were selected from this database of contacts.

In addition, extensive use was made of INPUT's corporate library located in Mountain View, California. The resources in this library include on-line periodical databases, subscriptions to a broad range of computer and general business periodicals, continually updated files on more than 3,000 information services vendors, and the most up-to-date U.S. Department of Commerce publications on industry statistics.

It must be noted that vendors may be unwilling to provide detailed revenue breakouts by product/service market or industry. Also, vendors often use different categories of industries and industry segments, or view their services as falling into different modes from those used by INPUT. Thus, INPUT must estimate revenues for these categories on a best-effort basis. For this reason, the product/service market and individual segment forecasts should be viewed as indicators of general patterns and trends rather than specific, detailed estimates for individual years.



## Appendix: Industry-Specific Definitions

Automatic Equipment Identification (AEI) is the term usually used for the millions of radio transponder tags being placed on freight equipment and shipping containers. In reality, there are three basic components of these systems: vehicle-mounted transponders, stationary interrogator units (reader/transmitters), and the computer systems to collect and utilize the data.

Transponders are small, normally passive electronic devices, about 2 inches by 9 inches, called tags. Two tags, one on each side, are placed on each unit. Tags are being placed on shipping containers, trailers, locomotives, freight cars, etc. The tag contains a specific number, unit type, ownership identification and an indication of the vehicle side. Costs per tag in 1993 were about \$30.

Interrogator units are radio transmitter/receivers located at fixed locations along railroad tracks, highways and in transfer yards. The interrogator units send out a low power signal, less than 20 watts. Transponders modulate this power to respond to the interrogator unit with their contained identification data. Interrogator units send this information along with their location identification to collection computers for processing. Although the location is only known as of the last interrogator passage, this is still a substantial advance in tracking.

Railroads are the most significant current users, having determined to remain with a terrestrial-based communications system. Rails are under an AAR edict to tag all equipment that moves across other company rails (about 1.4 million equipment pieces) by the end of 1994. Intermodal truckers are a part of this, but they do not have the same forced timetable. Current use is primarily with the carrier who has placed the interrogator units. However, the sharing of shipment location data with other transport and shipper/receiver companies is expected to occur rapidly—probably through EDI transmissions.

**Code sharing**—These agreements, which must be approved by the U.S. Department of Transportation and other national regulating bodies, allow the combining of flight numbers within CRS systems for different air carriers. The purpose is to facilitate customer servicing by providing a view of a single carrier regardless of the airline or corporate boundaries. For instance, the USAir ticket package for a U.S.-originated flight that terminates on a British Air subsidiary in Europe would contain a full set of boarding passes and provide through luggage forwarding. For unfamiliar passengers, the downside is a lack of prior knowledge that they are on a multileg journey, with potentially significant time lags.

**Double stack**—These are special low flatbed rail cars that permit containers to be loaded two high. The advantage is in doubling the capacity of a train without increasing its length. The disadvantage is that these higher and heavier loads cannot travel in all areas, particularly in many parts of Mexico. Prior to the Sarnia Tunnel from the U.S. to Canada, double stack between the two countries was impossible.

The Global Positioning System (GPS) is a satellite communications system developed by the U.S. Department of Defense to provide precision global location determination. Though built for military purposes, the basic theory is being used in nearly all transportation segments. It requires a special frequency receiver, that can determine its position on the globe within three meters. Its ability to provide continuous location sensing is superior to other methods. Airlines and the FAA see this as the eventual replacement for radar-based systems for Air Traffic Control. Its implementation by land and sea transport firms is to gather data on locations of "vehicles" and eventually specific cargo containers. The location data can also be captured by onboard computers and communicated to a transportation company's computers for processing.

**Intermodal**—A railroad term for any shipment transported by a railroad in a trailer or container that begins and/or ends with another transportation mode.

The Intelligent Vehicle Highway System (IVHS) generally uses land-mounted radio equipment to identify passing vehicles equipped with special transponders and, potentially, to communicate to them. The initial application appears to be for automated, nonstop toll collection by deducting from a prepaid account for each passage. Advocates see cutting congestion, possible nonstop truck weights and, futuristically, automated highways where closely spaced vehicles drive themselves under computer control as advantages. Detractors see invasion of

privacy as a problem, because vehicle locations could be known by those with computer access. This is a variant of AEI.

Multimodal—A transportation term used to describe a shipment that is moved by various modes during its journey from shipping point to ultimate customer. It is used to designate modes that do not directly fit the railroad "intermodal" definition. However, many use the two terms interchangeably.

Transponder—The dictionary defines a transponder as: "a radio or radar receiver-transmitter activated for transmission by reception of a predetermined signal." The use of these devices is in conjunction with AEI and IVHS technologies, which use radio signals to activate vehicle-mounted transponders to identify and communicate with specific vehicles.

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